

# Area Based Development and Climate Change in West Africa and Latin America

A World Bank Study of the Linkages between Institutions, Adaptation, and Vulnerability



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## Abstract

The role of institutions is critical to both climate change adaptation and development. Institutions bring in external resources, utilize location specific knowledge, and provide informational, technical and leadership support. Identifying who has access to institutions, what types of institutions are most frequently accessed, and how institutions can increase adaptive capacity are the key questions addressed in this report. The report is intended to inform the World Bank's efforts to build and strengthen institutions to facilitate adaptation to climate change in developing countries. Data from household surveys conducted in Burkina Faso, Niger, Senegal, the Dominican Republic and Mexico provided information on factors contributing to overall vulnerability, defined as a factor of exposure, adaptive capacity and sensitivity. Our analysis created groups of households clustered around these factors of vulnerability, and identified common relationships between groups. We found that groups with high exposure to climate hazards have invariably better access to institutions. Groups with better access also employ a greater number of adaptation strategies more frequently, and access government and civic organizations more than other types. Based on these relationships we suggest that to increase adaptive capacity in highly exposed areas, it is not necessary to create new institutions. We suggest that a more effective approach would be to strengthen existing institutions, especially government departments of natural resources, veterinary, health and agriculture, and civic organizations such as village committees, youth and women organizations. We also identified a relationship between market income and higher adaptive capacity, suggesting that institutions should encourage a diversity of assets, including a market income source. Finally, we identified the groups of households characterized as highly sensitive in order to identify their interaction with institutions. These groups currently have little to no institutional access, and considering the variability of climate change, are at risk of experiencing severe effects of climate hazards. Therefore we suggest that addressing the vulnerability of these groups preemptively is critical. Our findings suggest that as countries and development organizations are facing resource limitations, and environmental and demographic pressures, they should increase their efforts to build resilience in the communities through general adaptive capacity. Pre-emptive activity instead of a risk management, re-active approach will likely be more effective in addressing future climate change impacts.

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## Introduction

In a world in which 1.4 billion people live in extreme poverty<sup>1</sup> and global hunger continues to increase,<sup>2</sup> the impacts of climate change will not be evenly distributed. World Bank President Robert Zoellick called the world's poor "the most exposed to climate change, the most affected by it, and the least able to cope with it."<sup>3</sup> Close to 80 percent of the costs of future climatic hazards stand to be borne by less developed countries, given that they are particularly reliant on climate-sensitive ecosystem services and natural capital.<sup>4</sup> Furthermore, resources put toward responding to climate change cannot be used for critical development efforts that might protect less developed countries from the most severe climate impacts.<sup>5</sup> Policy makers in some developing countries are already being forced to shift more of their budgets to cope with weather-related emergencies.<sup>6</sup> Compounding the problem, the poorest people often live in physically vulnerable locations with economically precarious conditions, leaving them more susceptible to climate hazards. Thus, a vicious cycle perpetuates, in which climate change hampers development efforts, and low levels of development leave populations more vulnerable to climate impacts.



The description of vulnerability above parallels the Intergovernmental Panel on Climate Change (IPCC) definition used in this report. The IPCC defines vulnerability as susceptibility to or inability to cope with climate impacts. Vulnerability is a function of exposure, sensitivity and adaptive capacity to climate change.<sup>7</sup> Thus, living in hazard-prone (highly exposed) areas will increase climate impacts. Characteristics like disease and lack of education might cause households to suffer greater effects of a

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<sup>1</sup> The World Bank (2008) "Poverty Data." Supplement to World Development Indicators 2008. <<http://siteresources.worldbank.org/DATASTATISTICS/Resources/WDI08supplement1216.pdf>>.

<sup>2</sup> FAO. The State of Food Insecurity in the World. Rep. Food and Agriculture Organization, 2008.

<sup>3</sup> World Bank Group President says climate action can work for development." Press Release. December 12, 2007. <<http://beta.worldbank.org/node/3836>>.

<sup>4</sup> World Development Report 2010 - Development and Climate Change. Rep. p.43. Washington D.C.: The World Bank, 2010.

<sup>5</sup> World Development Report 2010 - Development and Climate Change. Rep. p.43. Washington D.C.: The World Bank, 2010.

<sup>6</sup> Lis, Eliza M., and Christiane Nickel. *The Impact of Extreme Weather Events on Budget Balances and Implications for Fiscal Policy*. Working paper no. 1055. European Central Bank, 2009.

<sup>7</sup> IPCC. "Glossary." *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2001. 981-96.

climate hazard (sensitivity), and other characteristics such as having a variety of assets might help some households deal with hazards more effectively than others (adaptive capacity).

A household with greater adaptive capacity will have lower overall vulnerability to climate change. Institutions, defined in this report as both formal and informal government (e.g. agricultural or health agency), private (e.g. bank or credit organization), or civil sector (e.g. community group or cooperative) organizations, play an important role in building adaptive capacity and furthering development. They bring external resources into isolated communities, and are able to use location-specific knowledge to put those resources to efficient use. Institutions also elicit community participation and can mediate disputes. Finally, they provide information and leadership support critical for development efforts.<sup>8</sup>

As in the case of development, institutions can play a key role in facilitating climate change adaptation. The literature suggests that local institutions channel external support for local adaptation efforts, provide key information about adaptation strategies, supply leadership and technological support for carrying out those strategies, and create improved market conditions that help households adapt more successfully.<sup>9</sup> An



adaptation is not necessarily successful—it is defined as any kind of response, positive or negative, to an actual or expected climate stimulus.<sup>10</sup> The presence of effective local institutions may aid households in responding successfully, rather than unsuccessfully, to the climatic challenges of the future.

This report describes five key findings related to adaptive capacity and institutions —1) households with high exposure have high institutional access, 2) institutional access supports the use and diversity of adaptation strategies, 3) the most adaptive households access government and civic institutions most frequently, 4) the most highly sensitive households have the least institutional access and lowest use of

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<sup>8</sup> Uphoff, Norman. *Local Institutions and Participation for Sustainable Development*. Rep. no. 31. London: International Institute for Environment and Development, 1992.

<sup>9</sup> Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. *Local Institutions and Climate Change Adaptation*. Working paper no. 113. Washington DC: The World Bank, 2008.

<sup>10</sup> IPCC. "Glossary." *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2001. 981-96.



adaptation strategies, 5) more adaptive households more frequently derive income from market-based sources. We recommend providing increased support to existing local civic and governmental institutions, promoting market-based income sources, and putting resources toward helping high-sensitivity, low-exposure households. We also identify areas that could benefit from further research.

These recommendations are aimed at better informing the World Bank's efforts to build and strengthen institutions to achieve development goals and facilitate adaptation to climate change in developing countries.



*A focus group conducted near the village of Djibo in Burkina Faso. Focus groups provided local insights in to what makes people more vulnerable. Overwhelmingly we heard that poor women farmers are the most vulnerable.*

## Scope of This Report

This report is part of a larger World Bank project studying the connections between development and adaptation to climate change in select West African and Latin American countries. This paper, the product of a team of University of Michigan students from the School of Natural Resources and Environment, focuses particularly on the relationship between household vulnerability to climate

change and access to institutions. We analyzed household surveys to create vulnerability profiles for similar groups of households. Our analysis addresses the following questions:

- Who has access to institutions?
- What types of institutions are most frequently accessed?
- In what ways can institutions improve adaptive capacity?

Because of time and resource restraints, the report focuses only on study sites in Senegal, Burkina Faso, Niger, the Dominican Republic, and Mexico. Data from Peru will be included in the broader study, but it was collected too late to be included in this analysis. Additionally, only household interviews and some information from community focus groups are used in this report. A more detailed analysis of focus group data and institutional and expert interviews will be completed as part of the final World Bank project.

The World Bank contracted the research in the West African and Latin American regions to two research NGOs – the Stockholm Environment Institute and the Latin American Center for Rural Development, respectively. These organizations worked with local country teams to carry out the data collection itself. A government agency called the Dominican Institute for Agricultural and Forestry Research managed the household interviews in the Dominican Republic, while local NGOs took that responsibility in West Africa.

The decentralization of data collection resulted in benefits and drawbacks. It allowed the World Bank to take advantage of local human, social, and cultural resources, as well as knowledge of local conditions. Surveys in each country could be tailored to unique geographical and social circumstances. Conversely though, it also meant that data collection was less than uniform. Each country team was given a master survey to work off of, but they had the autonomy to modify it as necessary. The resulting differences in the data sets present difficulties for cross-country comparison. All countries do share many commonalities, such as demographic information, adaptation strategies, asset ownership, and institutional access. But in some cases, questions about these topics were asked in different ways. For instance, land tenure rights are more complex in Mexico than in the Dominican Republic, necessitating that questions about land be asked differently in each of the countries.

Other differences in the data set can be attributed to the nature of the project's organizational complexity. In some cases, expectations were not effectively transmitted to all parties. In Mexico, for example, information was collected on household education level, but not literacy rate. Where



differences in the country data sets necessitated an adjustment in the analysis, it is indicated in the study results or appendices.

## Country Profiles



*A village in northern Burkina Faso.*



*Housing on a river in the Dominican Republic.*

Table 1 on the next page compares some of the key characteristics of each country. All of the countries fall at the lower end of the Human Development Index (HDI), especially the countries in West Africa – Niger is the lowest ranking country. Mexico has a higher ranking, but the state in which the study was conducted would rank lower on its own. The West African countries, all located in the Sahel region, experience similar climatic events, specifically variable rainfall and extreme droughts. Mexico also faces droughts, and along with the Dominican Republic experiences an increasing intensity and frequency of storms, and sea level rise. Across all five countries it is important to note the role of agriculture as a percentage of gross domestic product (GDP). Agriculture ranks as one of the top three sectors in each country (and in the state of Michoacan in Mexico). The reliance on agriculture is important to note, as it is likely that agricultural production in developing countries will be severely impacted by climate change.<sup>11</sup> A more detailed description of the country contexts, including a description of the regions where the surveys were conducted, is included in Appendix 1.

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<sup>11</sup> Rosenzweig, Cynthia & Martin L. Parry. "Potential impacts of climate change on world food supply. *Nature*. 367 (1994). 133-138.

Table 1: Country Statistics

Country (HDI rank)	Population	Land Area (% arable)	GDP-PPP (per capita)	Climate Variability & Hazards	Primary Livelihood (% of GDP)
Niger (182)	15.3 m	1,267,000 km <sup>2</sup> (11%)	\$10.3 bn (\$700)	- Variable rainfall - Extreme droughts	- Agriculture (39) - Industry (17) - Services (44)
Senegal (166)	13.7 m	196,722 km <sup>2</sup> (12.5%)	\$218 bn (\$1,600)	- Variable rainfall - Prolonged droughts	- Agriculture (16) - Industry (19) - Services (65)
Burkina Faso (177)	15.7 m	274,000 km <sup>2</sup> (17.7%)	\$17.9 bn (\$1,200)	- Droughts - Floods - Heat waves - Dust storms - Dry zone extension	- Agriculture (29) - Industry (20) - Services (51)
Dominican Republic (90)	9.6 m	48,670 km <sup>2</sup> (22.5%)	\$78.2 bn (\$8,200)	- Decreasing rainfall - Increased frequency and intensity of storms - Sea level rise	- Agriculture (15) - Industry (23) - Services (66)
Mexico (53)	112.2 m	1,964,375 km <sup>2</sup> (12.7%)	\$1567 bn (\$14,300)	- Variable rainfall - <b>Droughts</b> - <b>Sea level rise</b> - <b>Tropical storms</b>	- Agriculture (15) - Industry (26) - Services (59)
<b>State of Michoacán (~107)</b>	<b>3.96 m</b>	<b>59,864 km<sup>2</sup></b>	<b>\$18.7 bn*</b> <small>*nominal not PPP</small>		<b>- Agriculture (12.5)</b>

Sources: CIA (2009); UNDP (2009); Government of Mexico website

## Methodology

### Data Collection

Household survey data, used for our quantitative analysis, was collected from each of the five countries. In each of the Latin American countries, eight sites were selected to represent four different municipalities. The two sites in each municipality included one site relatively close to the municipal seat and one further away. Local research teams conducted 240 household surveys per country. The surveys collected information on a variety of topics, including household demographics, experience of climate hazards, household sources of income, employment of adaptation strategies, and institutional access. The country surveys are included in Appendix 2.

Site selection in West Africa varied by country; Senegal, Burkina Faso, and Niger used the same survey but different techniques to gather household survey data. In Senegal, the local team conducted surveys

at up to four villages in six different regions. In Burkina Faso, data was collected in three regions representing high, moderate, and low historic levels of exposure to climate variability and hazards. Lastly, data collection efforts in Niger were broken into four regional efforts, all in the southern, Sahelian portion of the country. The West African countries ranged from 120 to 127 household surveys per country.

The quantitative information provided by household surveys was supplemented by qualitative results from focus groups, institutional interviews, and expert interviews. In West Africa, local teams conducted several meetings in each community, covering a variety of demographic groups and perspectives (men, women, pastoralists, ranchers). This was slightly different in the Dominican Republic where only one meeting was held in each of the eight communities. In each country, the focus groups included between 10 and 20 participants. These participants discussed topics similar to those covered in the household interviews, but the forum for the discussion produced qualitative data that will be used to enhance the quantitative findings. A formal analysis of the focus group data is beyond the scope of this report. However, reoccurring points made by the focus groups were identified to provide explanatory support for the quantitative analysis.

## ***Analysis***

### **Vulnerability Profiles**

Methods for measuring vulnerability are heavily debated in the literature. We followed the IPCC definition of vulnerability, outlined in Table 2 below. According to this definition, vulnerability is a function of exposure, sensitivity and adaptive capacity. This categorization is at the heart of our analysis, with specific household survey data used to measure exposure, sensitivity and adaptive capacity.

Table 2: Vulnerability Factors

<b>Vulnerability</b>		
<b>Exposure</b>	<b>Adaptive Capacity</b>	<b>Sensitivity</b>
- Number of climate hazards	- Asset diversity - Diversity of institutional access - Frequency of contact with institutions	- Total income - Income diversity - Incidence of disease - Household size - Literacy rate

*Exposure* is the nature and degree to which a system is exposed to significant climatic variations.<sup>12</sup> Household interviews measured exposure by asking how many times the household experienced specific climate hazards in the past ten years. The type of climate events included in the survey varied with respect to the country; for instance, the Latin American surveys included a question about hurricanes, which was unnecessary in West African surveys. The primary climate hazards recorded by the household surveys include drought, flood, hurricanes, and storms. We recognize that households may not accurately recall the actual number of climate events in the past ten years, but our survey results reflect the perceived exposure upon which household decisions are made. In West African countries, the mode of climate hazards reported per community was assigned to each household within the given community. A similar technique, using the mean of climate hazards reported in each community, was used in Latin America. Using the mode and the mean to determine household exposure allowed us to address the uncharacteristic responses of low exposure which we noted were related to younger heads of households. These individuals may have limited memory of the past decade, and did not have their current responsibilities throughout this period of time. Thus, their awareness of climate hazards would be different from older heads of households, who have been aware of conditions that impact their ability to generate a livelihood over the past ten years.

*Sensitivity* is the degree to which a system is affected, either directly or indirectly, by climate related events.<sup>13</sup> It is determined by a variety of community or household characteristics.<sup>14</sup> The variables we used to measure household sensitivity are total income, diversity of income sources, incidence of disease, household size, and literacy rate.

Diversity of income sources and incidence of disease are important indicators of sensitivity. Households that earn income from a variety of spatial and sectoral sources are less sensitive to local climate hazards. Disease burden also increases sensitivity, as households dealing with disease are able to spend less time earning income and preparing for environmental stressors.<sup>15</sup> Total income also impacts a household's

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<sup>12</sup> Fussel, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29.

<sup>13</sup> Fussel, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29.

<sup>14</sup> Smit, Barry, and Johanna Wandel. "Adaptation, Adaptive Capacity and Vulnerability." *Global Environmental Change* 16 (2006): 282-92. Print.

<sup>15</sup> IPCC. "Human Health." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2007. 391-432.

ability to manipulate its own sensitivity. Households that can afford to irrigate fields or get access to indoor plumbing may have a greater buffer against climate impacts.

Literacy rate can be used as a proxy for education. In the Dominican Republic, specific questions were asked about the number of literate people in the household. In the other four countries, this variable was defined by the number of people in a household with formal education. The number of literate people (both directly and in terms of formal education) was divided by the number of people in the household to get a rough proxy for the percentage of people in the household that have education. This measure reflects sensitivity because educated people can contribute to diversifying income sources in times of need or taking in and processing climate related information.

The last variable used to determine sensitivity is household size. The relationship between household size and sensitivity is unclear. A larger household may have more people to bring in income, which would decrease sensitivity, or it may have a large number of dependent children draining household resources and increasing sensitivity. Household size is further discussed in the results section.

*Adaptive capacity* is the ability of a system to adjust to climate change, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences of climate stressors.<sup>16</sup> The variables asset diversity, diversity of institutional access, and frequency of contact with institutions were used as measures of household adaptive capacity. Greater asset diversity can increase adaptive capacity because these assets can be used to recover in the wake of a climate event. Ownership of a motor vehicle, for instance, allows for mobility of either household members or other important assets, such as farm equipment. Both frequency of contact with institutions and the diversity of institutions accessed increase household adaptive capacity. Institutions are the mechanisms by which information and funding are relayed to communities -- greater access to institutions provides households with crucial knowledge and resources.

To create the vulnerability profiles, cluster analysis was performed using a hierarchical cluster method in Stata (Ward's method). Households were clustered around the variables measuring exposure, sensitivity, and adaptive capacity; this technique maximizes similarity within groups of households while maximizing dissimilarity between groups of households. All variables were standardized during clustering, and the Kruskal-Wallis test of variance was performed on the same variables across clusters to determine statistically significant differences.

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<sup>16</sup> Fussler, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29.



## Cluster Analysis

Using the household survey results we analyzed each cluster's relative vulnerability and described them based on their relative exposure, adaptive capacity and sensitivity. It is important to note that these are relative measures and that the actual values of the variables cannot be compared across countries; only the relative trends from each country can be compared. Once we determined relative exposure, sensitivity and adaptive capacity, we analyzed each cluster's use of adaptation strategies, main income source and access to institutions.

### Who makes up the clusters?



Behind the descriptions of “most adaptive, more sensitive and highly exposed households” are real men and women who responded to the survey questions. These men and women can be characterized more specifically by their level of income, years of education, and disease burden. A woman with little to no income, very little education and a high frequency of disease most likely is included in the “highly sensitive” group. Alternatively, a male who owns a house, cattle, and a blacksmith shop would be less sensitive to climate hazards because if a drought results in a loss of his cattle, he still has two other sources of income to draw from. He is better able to respond to a climate hazard. This type of characterization is supported by the qualitative discussion in focus groups. Focus groups in West Africa when asked “who is the most vulnerable group” responded that “poor women farmers are the most vulnerable.” Highlighting the people behind the household survey results provides a context to understand that the goal of institutions should be to support the men and women who make up the groups that we discuss

## Study Results and Key Findings

Each of the countries studied, and to a lesser extent each of the communities surveyed, presents a very different picture in terms of culture, politics, level of development. Despite these differences in context we observed common relationships between clusters not only within and across countries, but across both regions. While the absolute values of measured variables are not comparable across country, the relative relationships between clusters are. In order to see these relationships more clearly each cluster was identified and named in terms of exposure, sensitivity and adaptive capacity based on the vulnerability profiles (see Appendix 3 for detailed results). Shown in Table 3 are the names and relative rankings of each cluster. Further conclusions were drawn by comparing each of these clusters on other relevant variables not used in the clustering process; these findings are reported in detail below. The first pattern we identified was that the group with the highest incidence of climate hazard in the past 10 years was also the group that has the highest frequency of contact with institutions. These households have relatively better access to institutions compared to the households in other groups. This group has more households that employ adaptation strategies compared to other groups and the diversity of these strategies is also greater. Specifically, government level resource and health organizations, and village level civic organizations seem to be the key organizations leading to increased employment of adaptation. Having non-farm income is also characteristic of the highly adaptive group. Alarming, in West Africa, the group that is highly sensitive has the lowest institutional access, suggesting that this group is neglected by institutions. While this group does not currently report high exposure, they have potential for disproportionate impacts from climate change should their exposure to climate hazards increase.

Table 3: Vulnerability Profiles

	Cluster	Adaptive Capacity	Sensitivity	Exposure	Diversity of Adaptation Strategies	Key Institutions
Senegal	High adaptive capacity (n=39)	High	Low	Moderate	1	- Government - Community
	High sensitivity (n=55)	Low	High	Moderate	1.45	
	High exposure to hazards (n=33)	Moderate	Moderate	High	1.42	
Niger	High adaptive capacity and high exposure to hazards (n=43)	High	Moderate	High	4.35	- Milk coops
	High sensitivity (n=44)	Moderate	Moderate	Moderate	3.2	
	Low sensitivity and low exposure (n=33)	Moderate	Low	Low	3.5	
Burkina Faso	High adaptive capacity and high exposure to hazards (n=63)	High	Low	High	2.0	- Government - Community
	Low adaptive capacity and low exposure to hazards (n=57)	Low	High	Low	1.0	
Dominican Republic	High adaptive capacity/ high exposure (n=108)	High	Moderate	High	4.35	- Red Cross - Civil Defense - SESPAS - Auntamiento
	High sensitivity (n=82)	Moderate	High	Moderate	3.2	
	Low sensitivity (n=50)	Moderate	Low	Moderate	3.5	
Mexico	High exposure (n=76)	Moderate	Moderate	High	2.67	
	High adaptive capacity and high sensitivity (n=89)	High	High	Moderate	2.79	- Procampo - Oportunidad - 70 y mas
	Low adaptive capacity (n=75)	Low	Moderate	Moderate	2.08	

**1. Households with high exposure to climate hazards have higher frequency of contact with institutions, which is an important indicator of high adaptive capacity.**

It is not surprising that households with higher levels of exposure also report more institutional access. These households need the extra support institutions provide and crisis situations allow institutions to provide short term tangible results. Existing literature notes that crises tend to be catalysts for the formation of community institutions<sup>17</sup> and government support.<sup>18</sup> This was also noted in a conversation with Dr. Taonda, a professor at the “Institut National des Etudes et de Recherches Agricoles (INERA)” and implementer of the study in Burkina Faso. He noted that aid institutions concentrate in the north of the country where more extreme climate variability imposes great consequences for the local population. Climate hazard events provide institutions with a clear goal and the opportunity for visible results<sup>19</sup>.

Literature also suggests that NGOs tend to concentrate in areas that already have a strong NGO presence and a “flocking” behavior is observed<sup>20</sup>. This is particularly visible in Thies, Senegal, which has a disproportionate amount of institutional involvement compared to the rest of the country and may partially explain why this relationship between high exposure and high frequency of institutional access is not as strong in Senegal. In Senegal, the group reporting the highest level of exposure has the second



highest frequency of institutional contact and the group with the lowest exposure has the highest frequency of institutional contact. This flocking behavior may be a result of resource and infrastructure limitations. Locating projects where other NGOs have already identified a need may be a more cost effective way of citing projects than independently identifying appropriate communities or areas. This flocking behavior may also be a result of

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<sup>17</sup> Sills, Patrick, Hugh Butcher, Patricia Collis, and Andrew Glen. "The Formation and Forms of Community Groups." *Nonprofit & Voluntary Sector Quarterly* 9.1-4 (1980): 189-202.

<sup>18</sup> Adger, Neil. "Vulnerability." *Global Environmental Change* 16.3 (2006): 268-81.

<sup>19</sup> Fruttero, Anna, and Varun Gauri. "The strategic choices of NGOs: location decisions in rural Bangladesh." *Journal of Development Studies* 41.5 (2005): 759-87.

<sup>20</sup> Koch, Dirk-Jan, Axel Dreher, Peter Nunnenkamp, and Rainer Thiele. Keeping a Low Profile: What Determines the Allocation of Aid by Non-Governmental Organizations? Working paper no. 1406. Kiel: Kiel Institute for the World Economy, 2008.

infrastructure constraints and this is a particular problem in the least developed countries where a lack of road infrastructure makes it difficult to move both institutional resources and personnel.

Research shows that the presence of institutions can buffer the effects of climate hazards<sup>21</sup>. However, institutions are often constrained by limited resources, bureaucratic barriers and difficulties coordinating efforts. The same climatic phenomenon affects the livelihoods of local residents to a different degree and the effectiveness of institutions depends on the nature of local governance and available resources<sup>22</sup>. In areas of high exposure there is already a strong institutional presence-- rather than simply increasing the number of institutions in these areas, it is important to consider the existing institutions' resources and coordination.

## 2. Clusters characterized by greater institutional access and high frequency of access, also:

**a) Have a greater percentage of households that employ adaptation strategies (see Figures A, B)**

**b) Employ a greater diversity of adaptation strategies<sup>23</sup>**

These findings further support the claims made in the literature that institutions play an important role in facilitating adaptation<sup>24, 25</sup>. Effective institutions provide technical, informational, financial and leadership support<sup>26</sup> - the necessary components for successful adaptation<sup>27</sup>. The IPCC considers countries or areas with well developed institutions to have higher adaptive capacity.<sup>28</sup> By providing a range of services,



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<sup>21</sup> Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. Local Institutions and Climate Change Adaptation. Working paper no. 113. Washington DC: The World Bank, 2008.

<sup>22</sup> Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. Local Institutions and Climate Change Adaptation. Working paper no. 113. Washington DC: The World Bank, 2008.

<sup>23</sup> This is demonstrated in every country but Senegal.

<sup>24</sup> Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. *Local Institutions and Climate Change Adaptation*. Working paper no. 113. Washington DC: The World Bank, 2008.

<sup>25</sup> Uphoff, Norman. *Local Institutions and Participation for Sustainable Development*. Rep. no. 31. London: International Institute for Environment and Development, 1992. Print. Gatekeeper Ser

<sup>26</sup> Rural Community Empowerment Program. "Rural Institutions and Climate Change." *The World Bank, Social Development*. The World Bank. Web. 5 Dec. 2009.

<sup>27</sup> Fussel, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29. p. 304

<sup>28</sup> IPCC. "Glossary." *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2001. 981-96.



institutions also enable people to undertake a more diverse set of adaptation strategies.<sup>29</sup> While these assumptions are prevalent in the literature, few studies have empirically shown the specific relationship between institutional access and employment of different adaptation strategies across countries and regions. Our results show that high institutional access relates not only to a greater use of adaptation strategies but also to a higher diversity of adaptation strategies employed. The data from the Dominican Republic was particularly rich in this area and asked specific questions regarding the use of adaptation strategies. The group characterized by high institutional access and overall greater use of adaptation strategies showed particular significances in their use of mobility, stockage and pooling. More specifically, they use mobility of the house, storage of food and water, and pooling in the construction of a house.

Even though there is a connection between institutions and the employment of adaptation strategies, this does not necessarily imply the effectiveness of the adaptation strategies utilized<sup>30</sup>. It is very difficult to determine how much worse off

#### **Mobility as an adaptation strategy:**

Mobility is the most common adaptation strategy employed in Niger, Burkina Faso and the Dominican Republic. Mobility occurs at different levels. One type of mobility is moving cattle from an area experiencing severe drought to one where there is some water and vegetation. Another example of mobility is moving from a village to a city in order to find work or money. The entire household may move, or one representative of the household may travel with the cattle or move to the city in order to send money and resources back to the village. People that are not able to employ mobility are often the most sensitive households. Women heads of households are not able to leave their families to move cattle; families that rely on subsistence agriculture are not able to “get up and leave” like the cattle herders, as they would be leaving their only source of food and income. For people that lack resources (for instance food from an NGO during a flood or drought) or a diversity of assets (for instance income from a shop or a transfer of remittances from a different village or the city) mobility is a critical adaptation strategy that people often employ.

<sup>29</sup> Castellanos, Edwin J., Sandra De Urioste, and Ana Lucia Solano. "Institutions and adaptation strategies in rural Mesoamerica: The role of civil organizations in facing global changes in the coffee sector." [Http://www.openmeeting2009.org/](http://www.openmeeting2009.org/). Proc. of 7th International Science Conference on the Human Dimensions of Climate Change, Bonn. Germany. International Human Dimensions Program. Web. 5 Dec. 2009.

<sup>30</sup> See methodology note on measuring the effect of adaptation strategies.

households would be if they had not employed a given adaptation strategy. This study attempted to measure the effects of each adaptation strategy on the environment, household equality, the ability to make a living, and status in the community. However, the results were inconclusive. Nearly all households reported neutral effects of each strategy indicating that they either did not understand the question properly or are unable to determine the effects. We were able to measure the cost of adaptation strategies in the West African countries with more confidence.

**3. More adaptive households (within clusters characterized by high usage and diversity of adaptation strategies) access specific government and civic institutions more frequently than other types.<sup>31</sup>**

Given that groups experiencing high exposure to climate hazards also have better institutional access and that there is a link between institutional access and the use of adaptation strategies, it is important to identify the specific institutions which highly adaptive households are accessing. Across all of West Africa, clusters characterized by high adaptive capacity have relatively higher access to government and self-organized institutions as compared to other groups. Highly adaptive households have significantly better access to government departments, specifically forestry (natural resources), health, veterinary and agriculture departments, and self-organized groups including village committees, youth groups, and women’s organizations. Additionally, these households have better access to banks and NGOs. They do not have significantly better access to cooperatives, self-help, users groups, and religious organizations (with the exception of Burkina Faso). This indicates that these groups are not significant in

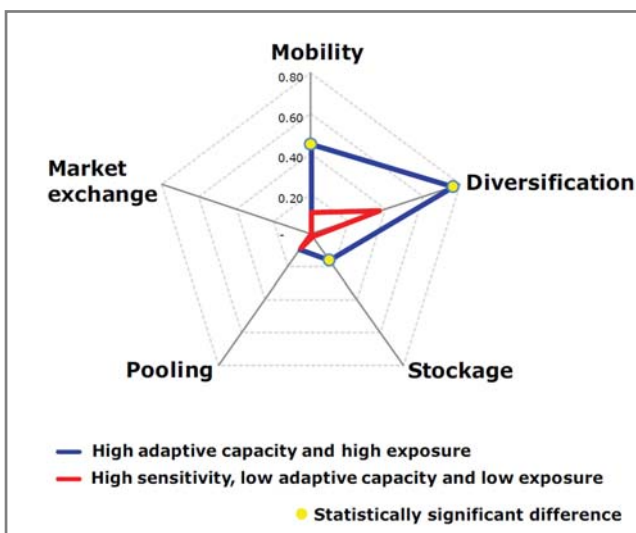


Figure 1 Burkina Faso - Use of Adaptation Strategies

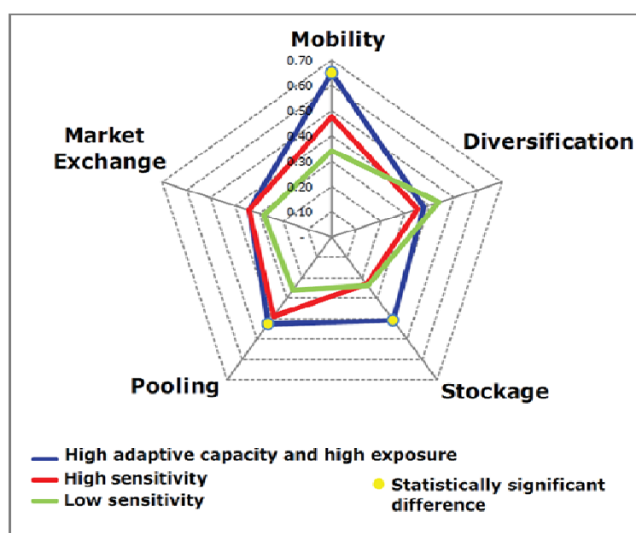


Figure 2 Dominican Republic - Use of Adaptation Strategies

<sup>31</sup> The types of institutions included in government and civic organizations vary regionally.

differentiating the adaptive capacity among the households. This may be contrary to the findings in the literature that show that agricultural cooperatives play a role in the adoption of farm practices that contribute to climate change adaptation.<sup>32</sup> Few studies have been done on the effects of cooperatives in these particular countries and the specialized nature of cooperatives may inhibit group members from diversifying their income (e.g. milk cooperatives are focused on milk production and might not have resources or motivation to encourage diversification out of cattle herding). In Mexico, high adaptive capacity households primarily access government institutions, in particular, “Procampo”, “Opportunity” and “70 and Over.”<sup>33</sup> They also access institutions that provide insurance. In the Dominican Republic high adaptive households access government institutions, particularly SESPAS<sup>34</sup> and municipal government as well as external civic organizations such as the Red Cross and Civil Defense, which 90 percent of the households in this group reported access to.

The prevalence of governmental institutional access may be a product of both the number and scale at which these institutions operate. Focus group respondents in Burkina Faso identified nearly all projects undertaken in the village as having some connection to the Chief or local government. More insightful is the role of local, self-organized institutions. Quotes from focus group discussions in the Dominican Republic described the perceived importance and benefit of these institutions. Participants explained: “The neighbors' group is the institution that plays the most important role, because it knows where the most help is needed.” (Castañuela, El Ahogado) “The ideal would be to distribute aid through the neighbors' groups, but most of the time they aren't used.” (Castañuela, El Ahogado)

The literature further supports the importance of local institutions, highlighting factors such location-specific knowledge and the ability to mobilize appropriate resources.<sup>35,36</sup>

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<sup>32</sup> Climate&Disasters." NedacHome. NEDAC. Web. 05 Dec. 2009  
<[http://nedac.org.in/index\\_files/climateanddisasters.html](http://nedac.org.in/index_files/climateanddisasters.html)>

<sup>33</sup> *Procampo* (Programa de apoyos directos al campo)- a program to compensate rural farmers for the agricultural subsidies their foreign competitors receive; *Programa 70 y mas*- economic support and social services for seniors (aged 70 and older); *Programa Oportunidades*- A human development program for those in extreme poverty -- includes health, nutrition, education, and income support.

<sup>34</sup> SESPAS – Department of Public Health and Social Assistance;

<sup>35</sup> Uphoff, Norman. *Local Institutions and Participation for Sustainable Development*. Rep. no. 31. London: International Institute for Environment and Development, 1992.

<sup>36</sup> Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. *Local Institutions and Climate Change Adaptation*. Working paper no. 113. Washington DC: The World Bank, 2008.

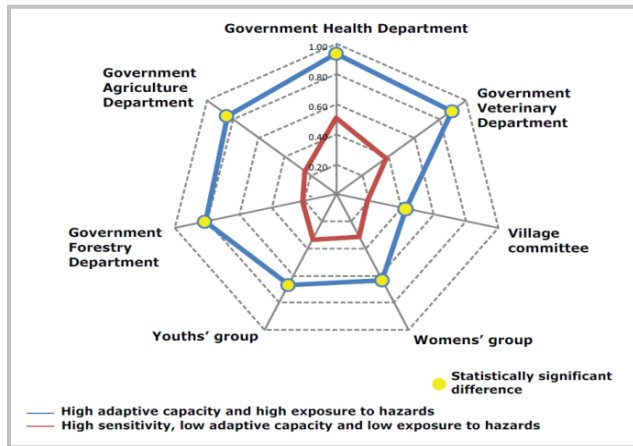


Figure 3 Burkina Faso - Access to Government and Civic Organizations

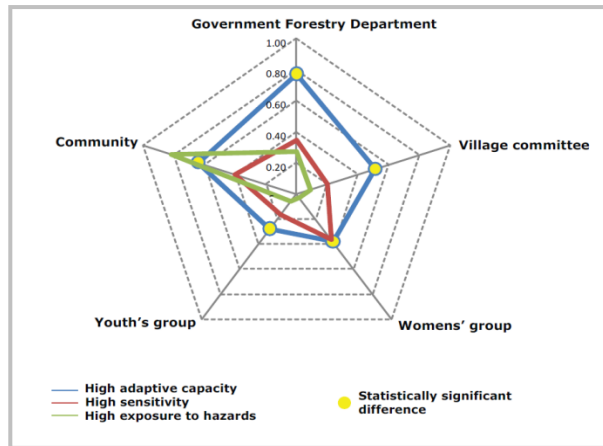


Figure 4 Senegal - Access to Government and Civic Organizations

#### 4. Highly sensitive households lag significantly behind others in both institutional access and the use of adaptation strategies.

Households characterized by low income, low diversity of income sources, high incidence of disease and smaller family sizes are considered highly sensitive to climate hazards<sup>37, 38</sup>. Invariably, the households use fewer adaptation strategies overall. The gaps in adaptation use (shown in Figure 5) between highly sensitive and less sensitive households vary by country; however, both lower use and less diversity of adaptation strategies are employed by households in clusters defined by relative high sensitivity.

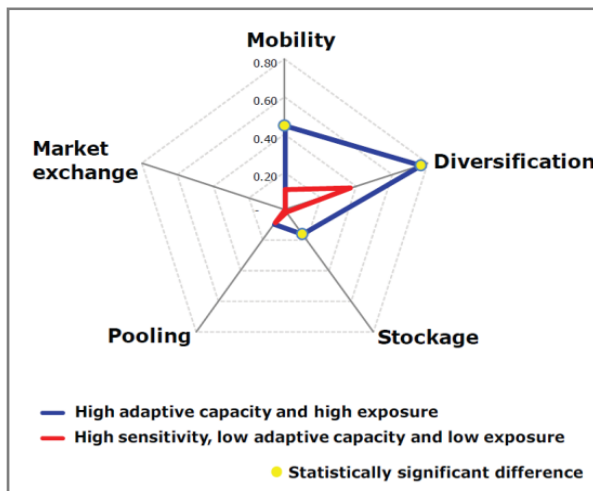


Figure 3 Burkina Faso - Use of Adaptation Strategies  
*Highly sensitive households lag in institutional access behind all others*

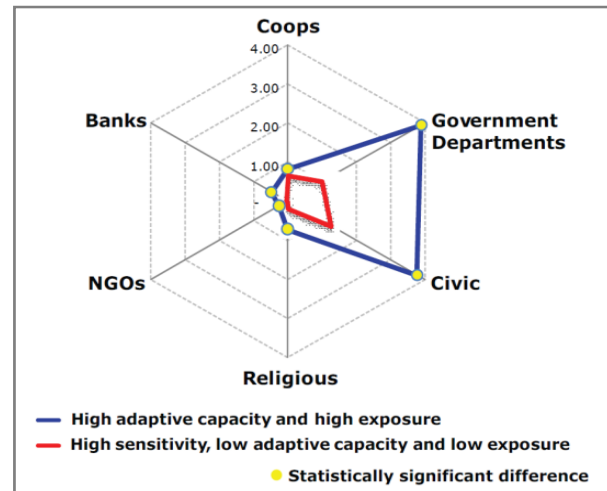


Figure 4 Burkina Faso - Access to Institutions - *Highly sensitive households access all types of institutions significantly less than the less sensitive ones*

<sup>37</sup> Brenkert, Antoinette L., and Elizabeth L. Malone. "Modeling Vulnerability and Resilience to Climate Change: A Case Study of India and Indian States." *Climatic Change* 72.1-2 (2005): 57-102.

<sup>38</sup> Polsky, Coling, Rob Neff, and Brent Yarnal. "Building Comparable Global Change Vulnerability Assessments: The Vulnerability Soping Diagram." *Global Environmental Change* 17 (2007): 472-85.

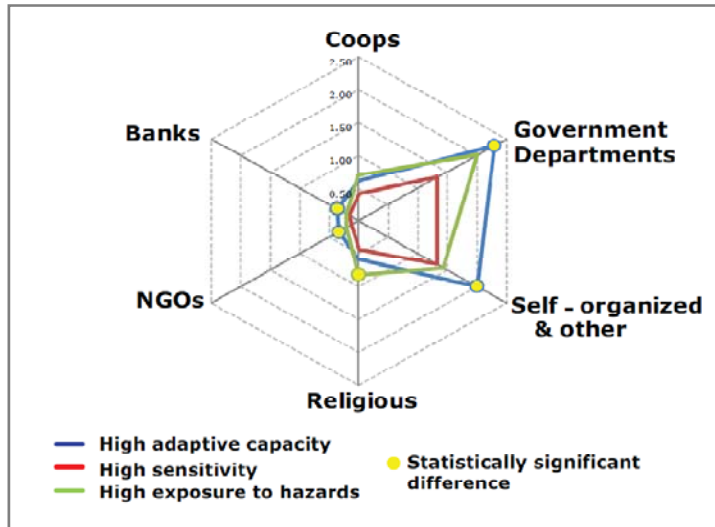


Figure 5 Senegal - Access to Institutions - *Highly sensitive households do significantly less to protect their livelihoods than less sensitive ones.*

partially explains the different use of adaptation strategies (e.g. cattle herders find it easier to employ mobility than agriculturalists)<sup>39</sup> other factors could provide further explanations. For example, highly sensitive households have significantly less access to institutions, which might explain the discrepancy in adaptation use. As previously discussed, institutions provide information, organizational capabilities and necessary resources,<sup>40</sup> which promote adaptation. Additionally, we found that these households have historically low to moderate exposure. The lack of institutional access might be a consequence of the observed institutional “bias” towards locating in high exposure areas, the general reactive nature of institutions, or the aforementioned NGO “flocking”<sup>41</sup> tendencies. This is particularly notable in Burkina (Figures 5 and 6) where sensitive households seem to be neglected by every institution type – from government, NGOs, to civic and religious ones. We observe similar patterns in Senegal, Niger and Dominican Republic (Figure 7, and Appendix 4).

The situation in Mexico is marginally different; highly sensitive clusters have similar institutional access compared to other clusters. This might be a result of greater institutional capacity or simply better access – Mexico has by far the best infrastructure of the countries researched.

<sup>39</sup> As observed in the focus groups conducted in the village of Dotoka in Northern Burkina Faso, Fulani cattle herders “get up and leave” when there is a drought.

<sup>40</sup> Uphoff, Norman. *Local Institutions and Participation for Sustainable Development*. Rep. no. 31. London: International Institute for Environment and Development,

<sup>41</sup> Koch, Dirk-Jan, Axel Dreher, Peter Nunnenkamp, and Rainer Thiele. *Keeping a Low Profile: What Determines the Allocation of Aid by Non-Governmental Organizations?* Working paper no. 1406. Kiel: Kiel Institute for the World Economy, 2008.

Given that these households usually have a low asset base (i.e. the average number of assets owned by highly sensitive households in Burkina Faso is 2.09, significantly lower than 3.37 for the less sensitive ones) and fewer income sources (almost exclusively agriculture and cattle herding), lack of actions to protect their livelihoods is placing these households at particular risk from the future impacts.

Although variation in income sources



The unpredictable nature of climate change could mean that these households will have greater exposure in the future, and without institutional access they will lack resources to adapt and the impact will be more severe<sup>42</sup>. Furthermore, existing literature strongly suggests that highly sensitive households are not in a position to reduce their sensitivity independently<sup>43, 44, 45, 46</sup> – either due to environmental conditions, or lack of resources and information. Initiatives and programs that fail to serve highly sensitive households in currently low exposure areas, risk leaving this population unprepared for potentially severe impacts of climate change.

### 5. Households with market based (non-farm) income tend to belong to the clusters with high adaptive capacity.

Specifically in West Africa, significantly more households from high capacity clusters derive income from market based mechanisms such as transfers, wage labor and trade. While these income sources are rarely considered to be key income (e.g. source accounting for more than 50 percent of total income), or single source of income, they seem to distinguish highly adaptive households from the others. This is consistent with findings in the literature that remittances provide a “buffering effect” against certain climate hazards,<sup>47</sup>

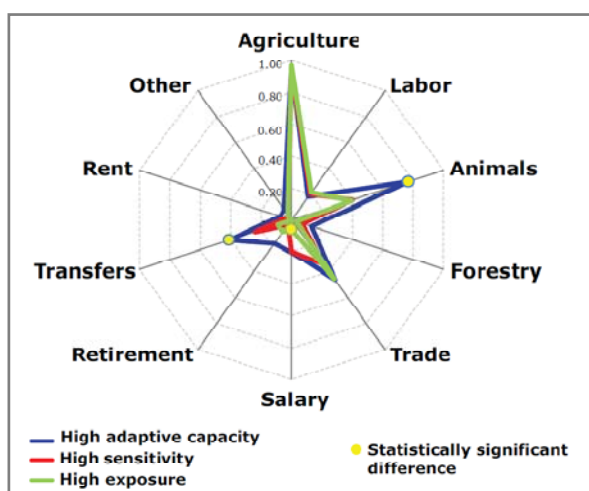


Figure 6 Senegal - Income Sources

as well as the role of remittances in increasing access to land and housing.<sup>48</sup> Remittances by definition come from outside locations and are likely not affected by the same climate hazards. Particularly in Senegal, remittances account for a very large portion of country GDP --estimates range from 7.6

<sup>42</sup> Fussel, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29.

<sup>43</sup> Barrett, Christopher B., and Michael R. Carter. "Can't Get Ahead for Falling Behind: New Directions for Development Policy to Escape Relief and Poverty Traps." *BASIS Brief* 2 (2000): 1-8.

<sup>44</sup> Dasgupta, Partha. "The Economics of Poverty in Poor Countries." *Scandinavian Journal of Economics* 1.100 (1998): 41-68.

<sup>45</sup> Tay, Natasya. "Climate Change: Women Central to Adaptation, Mitigation." *IPS Inter Press Service*. IPS ipsnews.net. Web. 06 Dec. 2009. <<http://ipsnews.net/news.asp?idnews=49323>>.

<sup>46</sup> Sayagues, Mercedes. "Development: Escaping the Poverty Trap - IPS ipsnews.net." *IPS Inter Press Service*. 14 Aug. 2009. Web. 06 Dec. 2009. <<http://ipsnews.net/news.asp?idnews=43566>>.

<sup>47</sup> Yang, Dean, and HwaJung Choi. *OxfordJournals*. Rep. Oxford University Press, 9 May 2007. Web. 6 Dec. 2009. <<http://wber.oxfordjournals.org/cgi/content/abstract/lhm003v1>>.

<sup>48</sup> Cotula, Lorenzo, and Camilla Toulmin. *Till to Tiller: Linkages Between International Remittances and Access to Land in West Africa*. Rep. FAO Livelihood Support Programme, 2004. Print.

percent<sup>49</sup> up to 14 percent<sup>50</sup> of the GDP, equaling the earnings from its main export – groundnuts. This affects the population both at the community level – by providing funds for development projects, and on the micro, household level by providing a source of income independent from local conditions. They also flow directly to households, unlike aid in many cases, which provides the recipients more flexibility in their spending choices, and might enable implementation of strategies not otherwise possible. In case of remittances from abroad (for example, the majority of remittances to Senegal are from France, Spain or other Western European countries), the amounts are significantly higher than locally earned income. This enables the receiving households to engage in capital-intensive projects such as house building. In focus groups from Burkina’s highly exposed north, villagers who own shops or are engaged in occupations such as blacksmithing indicate a lower need for external assistance.<sup>51</sup> These households also tend to have higher income and lower incidence of disease, leading to overall lower sensitivity compared to other clusters. The literature highlights risks involved in market based income sources,<sup>52,53</sup> such as exposure to market shocks, particularly in relation to climate hazards.<sup>54</sup> However, the scale of trade and non-farm activities that this research takes into account is sufficiently small to serve as a buffer against and broader market shocks. Most of these activities encompass only the village in which the household is based, or at most, the neighboring region. This limitation to the local level insulates households with market based income from any broader market shocks. It is worth noting that this is valid not only for non-agricultural products– as they are usually not transported far from the production site, but also for food products not intended for consumption, at least at the scale observed in this research (e.g.. communal vegetable gardens tended by women’s groups in the north of Burkina Faso for the food markets in Djibo, the main regional center).

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<sup>49</sup> Ratha, Dilip, and Zhimei Xu. *Migration and Remittances Factbook*. Rep. Washington DC: Development Prospect Group-World Bank. Print.

<sup>50</sup> Bedford, Julian. "Senegal's lifeblood drains away." *BBC NEWS*. 10 Mar. 2009. Web. 13 Dec. 2009.

<sup>51</sup> In the words of Dotoka blacksmith, referring to the impact 2008 drought had on his family’s livelihood: “There’s always some money, even in bad times”.

<sup>52</sup> *Income Generation and Poverty Reduction: Experiences of Selected Asian Countries*. Rep. no. 26. New York: UN ESCAP, 2005.

<sup>53</sup> "How to Feed the World." *The Economist* 19 Nov. 2009.

<sup>54</sup> Castellanos, Edwin J., Sandra De Urioste, and Ana Lucia Solano. "Institutions and adaptation strategies in rural Mesoamerica: The role of civil organizations in facing global changes in the coffee sector."

[Http://www.openmeeting2009.org/](http://www.openmeeting2009.org/). Proc. of 7th International Science Conference on the Human Dimensions of Climate Change, Bonn. Germany. International Human Dimensions Program. Web. 5 Dec. 2009.

## Recommendations

Based on the four primary findings – 1) households with high exposure have high institutional access, 2) institutional access supports the use and diversity of adaptation strategies, 3) the most adaptive households access government and civic institutions most frequently, 4) the most sensitive households have the least institutional access and lowest use of adaptation strategies, 5) more adaptive households more frequently derive income from market-based sources – this study recommends the following:

### **1. Increase the capacity of existing institutions.**

The relationship between frequency of institutional access and high exposure, noted in the first finding, indicates that institutions concentrate in exposed communities. However, the success of institutions in supporting effective adaptation remains unclear. Limited resources should be allocated to existing institutions to strengthen their capacity. Support for this recommendation comes from focus group discussions and institutional interviews. Focus group responses from the Dominican Republic suggest that institutions lack the resources to address the specific needs of the community to respond



effectively to climate hazards. Institutions without adequate capacity are constrained in their ability to be flexible in working with the community and other institutions<sup>55</sup>. An interview with a UNDP official in Burkina Faso indicates that the existing structure for interaction limits institutional responsiveness to the community's dynamic needs. These issues may be addressed through the formation of partnerships between institutions, the creation of a coordinating body to help allocate resources and responsibilities, or the restructuring of existing organizations to address these concerns.

## **2. Support government and civil-society organizations at the local level.**

Access to government and civil society organizations appears to be the basis for building adaptive capacity. Local level organizations are particularly effective in contributing location-specific knowledge and leveraging local resources.

## **3. Address the “trap” of highly sensitive households.**

Sensitive households that are not currently in high-exposure areas could experience increased exposure due to climate change. If left unaddressed, it is reasonable to assume that this population may experience heavy impacts from future climate hazards due to their low income diversity and poor health. Institutions, particularly government and civic, should increase their presence and/or activity in areas of high sensitivity, even if those areas are not currently experiencing high exposure. As these households are faced with the “poverty trap”, it is unlikely they will manage to reduce the sensitivity and improve their condition without external intervention, whether in the form of aid or information and resource sharing or capability building. This study recognizes the limitations of current climate models in predicting changes in exposure at the scale necessary to identify these particular populations. Institutions should use the best information available to determine areas of potentially high future exposure.

## **4. Promote conditions conducive to market-based income.**

Deriving income from market, non-farm based income is more common among the more adaptive households. Contingent upon the existence of adequate infrastructure, it may be possible for self-organized institutions to create better market access for the household's products, or enable other types of trade or salaried employment that might be less susceptible to climate hazards. However, any programs aimed at increasing market access should take into account the appropriate scale (local/regional) and potential for increased exposure to market shocks.

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<sup>55</sup> A Dominican Republic focus group response noted that “if the resources were managed well, they would be able to get to everyone; but it doesn't seem like they are managed well.

**5. Develop pre-emptive, general adaptive capacity in areas under the risk of climate change.**

While all of the countries surveyed have had significant experience in disaster response and crisis management, whether by government, local or external aid and development organizations, resulting in generally higher adaptive capacity of the highly exposed households, there is little evidence that such a reactive approach would be able to cope with future environmental conditions, especially taking into account demographic pressures, resource limitations and the increased climatic variability (drying of the Sahel, increased tropical storm frequency etc). Especially in the case of highly-sensitive and low-exposed households, institutions have an opportunity to build-in resilience in the community prior to the potential climate impact.

**6. Additional research should focus on measurements of the effectiveness of adaption strategies, consistent measures of vulnerability, incentivizing institutions and predicting climate exposure.**

Interview methods used for this research to collect data on the effects of adaptation strategies proved to be unreliable and the literature does not present a clear methodology for measuring these effects. Knowledge of which adaptation strategies are successful is necessary to inform decisions about which strategies to promote in a given region. In addition there is no consistent framework for evaluating household vulnerability. While some variables may differ across regions on how they relate to a household's vulnerability, standardizing variables of vulnerability would enable more reliable comparison of research results.





## References

- Adams, Richard H., and Jane J. He. *Sources of Income Inequality and Poverty in Rural Pakistan*. Rep. Washington DC: International Food Policy Institute, 1995. Print.
- Adger, Neil. "Vulnerability." *Global Environmental Change* 16.3 (2006): 268-81. Print.
- Adger, WN, and NW Arnell. "Successful Adaptation to Climate Change Across Scales." *Global Environmental Change* 15 (2005): 77-86. Print.
- Agrawal, Arun, Catherine McSweeney, and Nicolas Perrin. *Local Institutions and Climate Change Adaptation*. Working paper no. 113. Washington DC: The World Bank, 2008. Print.
- Amin, Ash, Jamie Peck, Eric Sheppard, and Adam Tickell. "Chapter 3 An Institutional Perspective on Regional Economic Development." *Reading Economic Geography*. Ed. Trevor J. Barnes. Malden, MA: Blackwell Ltd, 2004. 48-58. Print.
- Barrett, Christopher B., and Michael R. Carter. "Can't Get Ahead for Falling Behind: New Directions for Development Policy to Escape Relief and Poverty Traps." *BASIS Brief 2* (2000): 1-8. Print.
- Brenkert, Antoinette L., and Elizabeth L. Malone. "Modeling Vulnerability and Resilience to Climate Change: A Case Study of India and Indian States." *Climate Change* 72 (2005): 57-102. Print.
- Brenkert, Antoinette L., and Elizabeth L. Malone. "Modeling Vulnerability and Resilience to Climate Change: A Case Study of India and Indian States." *Climatic Change* 72.1-2 (2005): 57-102. Print.
- Castellanos, Edwin J., Sandra De Urioste, and Ana Lucia Solano. "Institutions and adaptation strategies in rural Mesoamerica: The role of civil organizations in facing global changes in the coffee sector." [Http://www.openmeeting2009.org/](http://www.openmeeting2009.org/). Proc. of 7th International Science Conference on the Human Dimensions of Climate Change, Bonn. Germany. International Human Dimensions Program. Web. 5 Dec. 2009.  
<[http://www.openmeeting2009.org/pdf\\_files/Pdf%20papers/Mesoamerica%20E%20Castellanos.pdf](http://www.openmeeting2009.org/pdf_files/Pdf%20papers/Mesoamerica%20E%20Castellanos.pdf)>.
- "Climate&Disasters." *NedacHome*. NEDAC. Web. 05 Dec. 2009.  
<[http://nedac.org.in/index\\_files/climateanddisasters.htm](http://nedac.org.in/index_files/climateanddisasters.htm)>.
- Cotula, Lorenzo, and Camilla Toulmin. *Till to Tiller: Linkages Between International Remittances and Access to Land in West Africa*. Rep. FAO Livelihood Support Programme, 2004. Print.
- Csaki, Csaba. *Reaching the Rural Poor : A Renewed Strategy for Rural Development*. Chicago: World Bank Publications, 2003. Print.
- Damiani, Octavio. "Rural development from a territorial perspective: Case studies from Asia and Latin America." MS. Washington DC. Inter-American Development Bank, Apr. 2007. Web.
- Dasgupta, Partha. "The Economics of Poverty in Poor Countries." *Scandinavian Journal of Economics* 1.100 (1998): 41-68. Print.

- Davies, Philip, Kim Turner, and Charlie Paton. *Potential of the Seawater Greenhouse in Middle Eastern Climates*. International Engineering Conference Paper, 26 Apr. 2004. Web.
- De Janvry, Alain, and Elisabeth Sadoulet. *Toward a territorial approach to rural development: International experiences and implications for Mexico's Microregions Strategy*. University of California at Berkeley, July 2004. Web.
- De Janvry, Alain, and Elisabeth Sadoulet. "Toward a territorial approach to rural development." *Journal of Agricultural and Development Economics* 4.1 (2007): 66-98. Print.
- "Dosso (Niger) -- Britannica Online Encyclopedia." *Encyclopedia - Britannica Online Encyclopedia*. Web. 01 Dec. 2009. <<http://www.britannica.com/EBchecked/topic/169756/Dosso>>.
- Echeverría, Ruben G. "Rural Poverty Reduction." MS. Inter-American Development Bank, Washington DC. 1998. Web.
- "Economy and Inequality." *Human Development Report*. United Nations Development Programme, 2009. Web. 4 Nov. 2009. <<http://hdrstats.undp.org/en/indicators/161.html>>.
- Encyclopedia - Britannica Online Encyclopedia*. Web. 01 Dec. 2009. <<http://www.britannica.com>>.
- FAO. *The State of Food Insecurity in the World*. Rep. Food and Agriculture Organization, 2008. Print.
- Fernandez-Cornejo, Jorge, and Margriet Caswell. "The First Decade of Genetically Engineered Crops in the United States." *USDA: Economic Research Service Economic Information Bulletin* 11 (2006). Print.
- Food and Agricultural Organization of the United Nations. "Reform of Rural Development Institutions." *Twenty-sixth FAO Regional Conference for Latin America and the Caribbean*. Merida, Mexico. Apr. 2000. Web.
- Fruttero, Anna, and Varun Gauri. "The strategic choices of NGOs: location decisions in rural Bangladesh." *Journal of Development Studies* 41.5 (2005): 759-87. Print.
- Fussel, Hans-Martin, and Richard JT Klein. "Climate change vulnerability assessments: an evolution of conceptual thinking." *Climatic Change* 75.3 (2006): 301-29. Print.
- Goldenberg, Mark. "A review of rural and regional development policies and programs." MS. Canadian Policy Research Networks. Mar. 2008. Web.
- "How to Feed the World." *The Economist* 19 Nov. 2009. Print.
- "Human Development Reports." *Undp.org*. United Nations. Web. 1 Dec. 2009. <<http://hdr.undp.org/en/statistics/>>.
- IFAD. "Annual Report 2001." MS. Rome. International Fund for Agricultural Development, 2001. Web.
- Income Generation and Poverty Reduction: Experiences of Selected Asian Countries*. Rep. no. 26. New York: UN ESCAP, 2005. Print.



- IPCC. "Assessment of adaptation practices, options, constraints and capacity." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2007. 717-43. Print.
- IPCC. "Glossary." *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2001. 981-96. Print.
- Koch, Dirk-Jan, Axel Dreher, Peter Nunnenkamp, and Rainer Thiele. *Keeping a Low Profile: What Determines the Allocation of Aid by Non-Governmental Organizations?* Working paper no. 1406. Kiel: Kiel Institute for the World Economy, 2008. Print.
- Lis, Eliza M., and Christiane Nickel. *The Impact of Extreme Weather Events on Budget Balances and Implications for Fiscal Policy*. Working paper no. 1055. European Central Bank, 2009. Print.
- Magrin, G., C. G. Garcia, D. C. Choque, J. C. Gimenez, A. R. Moreno, G. J. Nagy, C. Nobre, and A. Villamizar. "Latin America." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*,. Cambridge, UK: Cambridge UP, 2007. 581-615. Print.
- Maxson, Mark. "From Peanuts to Saltwater Greenhouses: Innovative Synergy at the Development Marketplace 2008." Weblog post. 25 Sept. 2008. Web.
- McSweeney, C., M. New, and G. Lizcano. "UNDP Climate Change Country Profiles: Dominican Republic." MS. 2008. Web. <<http://country-profiles.geog.ox.ac.uk/>>.
- Mimura, N., L. Nurse, R. F. McLean, J. Agard, L. Briguglio, P. Lefale, R. Payet, and G. Sem. "Small Islands." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2007. 687-716. Print.
- "Niger." *U.S. Department of State*. U.S.A. Government. Web. 21 Nov. 2009.  
<[http://search.state.gov/search?q=inmeta:dc\\_coverage~Niger&coverage=Niger&topic=&speaker=&pubtype=&partialfields=dc\\_coverage:Niger&displayname=Niger&sort=date:D:S:d1&filter=0&Search.x=0&Search.y=0&author=&start\\_date=&end\\_date=&as\\_occt=&as\\_filetype=&as\\_epq=&as\\_oq=&as\\_eq=&getfields=\\* &site=stategov\\_facet|oig|fpc|bmena|usawc|mepi|travel|stategov\\_exchanges|careers|foia|aiep|pepfar|cspo&entqr=3&getfields=\\* &entsp=0&output=xml\\_no\\_dtd&lr=lang\\_en&client=stategov\\_frontend&ud=1&search-button=Search&oe=UTF-8&ie=UTF-8&proxystylesheet=stategov\\_facet&search-button.x=0&search-button.y=0](http://search.state.gov/search?q=inmeta:dc_coverage~Niger&coverage=Niger&topic=&speaker=&pubtype=&partialfields=dc_coverage:Niger&displayname=Niger&sort=date:D:S:d1&filter=0&Search.x=0&Search.y=0&author=&start_date=&end_date=&as_occt=&as_filetype=&as_epq=&as_oq=&as_eq=&getfields=* &site=stategov_facet|oig|fpc|bmena|usawc|mepi|travel|stategov_exchanges|careers|foia|aiep|pepfar|cspo&entqr=3&getfields=* &entsp=0&output=xml_no_dtd&lr=lang_en&client=stategov_frontend&ud=1&search-button=Search&oe=UTF-8&ie=UTF-8&proxystylesheet=stategov_facet&search-button.x=0&search-button.y=0)>.
- Organization for Economic Cooperation and Development. "Rural Policy in Mexico." *OECD Rural Policy Reviews: Mexico*. Paris: OECD, 2007. 79-113. Print.
- Paton, Charlie. *Seawater Development for Oman: Thermodynamic Modeling and Economic Analysis*. Rep. no. 97-AS-005b. Muscat, Oman: The Middle East Desalination Research Center, 2001. Print.

- Peralta, Pablo O., Alejandra S. Ortiz, and Maria Arboleda. "Neo-Corporatism and Territorial Economic Development: The Ecuadorian Indigenous Movement in Local Government." *World Development* 36.12 (2008): 2921-936. Print.
- Pike, Andy, Andres Rodriguez-Pose, and John Tomaney. "What Kind of Local and Regional Development and for Whom?" *Regional Studies* 41.9 (2007): 1253-269. Print.
- Plan de Acción de Adaptación al Cambio Climático en la República Dominicana*. Rep. Santo Domingo: SEMARENA, 2008. Print.
- Polsky, Coling, Rob Neff, and Brent Yarnal. "Building Comparable Global Change Vulnerability Assessments: The Vulnerability Soping Diagram." *Global Environmental Change* 17 (2007): 472-85. Print.
- "Primera Comunicación Nacional." MS. Santo Domingo, Dominican Republic. United Nations Framework Convention on Climate Change, 2004. Web.
- "Programa de Acción Nacional de Lucha Contra la Desertificación y la Sequía de la República Dominicana." MS. Santo Domingo, Dominican Republic. United Nations Convention to Combat Desertification, 2006. Web.
- Quan, Julian, and Valerie Nelson. "Territory and rural development: concepts, methods, and approaches." MS. Land and Territory Research Paper No. 2. Dec. 2005. Web.
- Rachaputi, N. C., and G. C. Wright. "The Physiological Basis for Selection of Peanut Genotypes as Parents in Breeding for Improved Drought Resistance." *Breeding of Drought-Resistant Peanuts*. 2002. Print.
- "Regions of Senegal: Facts, Discussion Forum, and Encyclopedia Article." *AbsoluteAstronomy.com*. Web. 01 Dec. 2009. <[http://www.absoluteastronomy.com/topics/Regions\\_of\\_Senegal](http://www.absoluteastronomy.com/topics/Regions_of_Senegal)>.
- Reid, J. N., and Karen S. Murray. "Empowering rural communities: A perspective at the five-year point." *Annual Meeting of the Rural Sociological Society* (2000). Print.
- Reid, J. N. "Community empowerment: A new approach to rural development." *Rural Development Perspectives* (2000). Print.
- "República Dominicana." *Análisis Común de País* (2005). United Nations Development Group. Web. 4 Nov. 2009. <<http://www.undg.org/docs/8244/Analisis-Comun-de-Pa%EDs-RD.pdf>>.
- Roberson, Roy. "Transgenic Peanut Varieties Perform Well in Trial." *Southeast Farm Press* 12 Oct. 2007. Print.
- "Rural Institutions and Climate Change." *The World Bank, Social Development*. The World Bank. Web. 5 Dec. 2009. <<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/0,,contentMDK:21555832~isCURL:Y~pagePK:210058~piPK:210062~theSitePK:244363,00.html>>.

- Sayagues, Mercedes. "DEVELOPMENT: Escaping the Poverty Trap - IPS ipsnews.net." *IPS Inter Press Service*. 14 Aug. 2009. Web. 06 Dec. 2009. <<http://ipsnews.net/news.asp?idnews=43566>>.
- Scammell, Madeleine K., Laura Seiner, Jennifer Darrah-Okike, Phil Brown, and Susan Santos. "Tangible evidence, trust and power: Public perceptions of community environmental health studiesq." *Social Science and Medicine* 68 (2009): 143-53. Print.
- Schejtman, Alexander, and Julio A. Berdegué. "Desarrollo Territorial Rural." MS. RIMISP working paper, Santiago, Chile. 2003. Web.
- Sills, Patrick, Hugh Butcher, Patricia Collis, and Andrew Glen. "The Formation and Forms of Community Groups." *Nonprofit & Voluntary Sector Quarterly* 9.1-4 (1980): 189-202. Print.
- Smit, Barry, and Johanna Wandel. "Adaptation, Adaptive Capacity and Vulnerability." *Global Environmental Change* 16 (2006): 282-92. Print.
- Stancich, Rikki. "GM Crops: Biotech Agriculture - Time to Take GM Seriously." *Ethical Corporation* 07 Feb. 2008. Print.
- Swinburn, Gwen, Soraya Goga, and Fergus Murphy. "LOCAL ECONOMIC DEVELOPMENT: A PRIMER." *World Bank* (2006): 1-91. *Local Economic Development*. The World Bank, Jan. 2006. Web. 17 Jan. 2009. <[web.worldbank.org](http://web.worldbank.org)>.
- Tay, Natasya. "Climate Change: Women Central to Adaptation, Mitigation." *IPS Inter Press Service*. IPS ipsnews.net. Web. 06 Dec. 2009. <<http://ipsnews.net/news.asp?idnews=49323>>.
- Uphoff, Norman. *Local Institutions and Participation for Sustainable Development*. Rep. no. 31. London: International Institute for Environment and Development, 1992. Print. Gatekeeper Ser.
- World Development Report 2009: Reshaping Economic Geography*. Rep. The World Bank, 6 Nov. 2008. Web. 17 Jan. 2009. <[econ.worldbank.org](http://econ.worldbank.org)>.
- World Development Report 2010 - Development and Climate Change*. Rep. p.43. Washington D.C.: The World Bank, 2010. Print.
- World Economic Outlook Database*. International Monetary Fund, Oct. 2009. Web. 4 Nov. 2009. <<http://imf.org/external/pubs/ft/weo/2009/02/weodata/index.aspx>>.
- "The World Factbook, Niger." *Cia.gov*. US government. Web. 21 Nov. 2009. <<https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>>.
- Yang, Dean, and HwaJung Choi. *OxfordJournals*. Rep. Oxford University Press, 9 May 2007. Web. 6 Dec. 2009. <<http://wber.oxfordjournals.org/cgi/content/abstract/lhm003v1>>.

## Appendix 1: Country context and site selection descriptions

### Latin America Field Sites

#### ***Dominican Republic***

In the Dominican Republic, four municipalities were chosen around the country—two in the northeast (Nagua and Villa Riva), one in the northwest (Castañuela), and one in the southwest (Tamayo). Within each one, two communities were selected as field sites.

Nagua is a municipal seat and the capital of the Maria Trinidad Sánchez province. The municipality is on the northeastern coast of the island, just up the coast from the Samaná peninsula. The 2002 census puts the municipal population at 56,268, about 57% urban.<sup>1</sup> The two field sites are Matancitas and Los Yayaes. We were told that the people of Matancitas had been living literally on the beach in a community called La Playa (“the beach”) until the government moved them across the road to newly constructed minimal apartments. These communities are vulnerable to high sea levels caused by storms and, to a lesser extent, flooding from the nearby Nagua River.

South of Nagua in the neighboring state of Duarte is Villa Riva municipality, home to the study sites of Barraquito and Ceiba de los Pájaros. Villa Riva's population of 18,432 is heavily rural (69%).<sup>2</sup> The study communities border Los Haitises National Park are in the watershed of the Yuna River, one of the island's three major river systems. Flooding is a constant problem in the area. A new highway was recently constructed that gives the municipality better access to the capital, but the study communities remain somewhat remote.

In the northwest, Castañuela resides within Monte Cristi province near the border with Haiti. Its 2002 population of 13,748 is 71% rural.<sup>3</sup> The two study communities, El Ahogado and Magdalena, are within the flood plain of the Yaque del Norte River. The Yaque is another of the Dominican Republic's major rivers and is has caused significant damage to these communities in the past (“El Ahogado” means “the drowned one”).

The fourth municipality, Tamayo, is of a different character than the others. It is located in the southwest in Baoruco province. While the study communities, Uvilla and Mena, still suffer from intermittent flooding due to their proximity to the Yaque del Sur River, the region tends to be more arid and drought

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1 2002 Census of the Dominican Republic. Oficina Nacional de Estadística.  
<http://www.one.gob.do/index.php?module=articles&func=view&catid=70>

2 Ibid.

3 Ibid.

can be a concern. The southwest also tends to have less infrastructure than other parts of the country. Two thirds of Tamayo's population of 9,895 is urban.<sup>4</sup>

Although each of these communities has its own unique character, they share several common features. All are far from the capital and other major cities. Most tend to be rural, even if they are part of a more urbanized municipality. Agriculture tends to be a key income source, and the communities suffer from poor infrastructure.

### ***Mexico***

Four municipalities were also chosen in Mexico, all in the state of Michoacán. Michoacán is in southwestern Mexico bordering the Pacific Ocean and consists of ten socio-economic regions. Two municipalities (Epitacio Huerta and Contepec) are in the state's easternmost and furthest inland region, Oriente. The other two (Panindicuaro and Penjamillo) are in the northernmost region of Bajío. Each municipality contains two communities selected as field sites.

Oriente is the drier of the two study regions, having suffered a particularly large drought in 2005. Aridity is the norm in the region, however, and community members say that droughts have been increasing over the last decade. The municipalities of Epitacio Huerta and Contepec border each other in the northeastern tip of the Oriente region. The two study communities within Epitacio Huerta are Santa Cruz Ojo de Agua, with a population of 536, and La Luz, with a population of 724. In Contepec, the communities of Agua Caliente (population 951) and Pateo (population 948). La Luz in Epitacio Huerta and Pateo in Contepec are the more marginalized communities.

In general, Bajío tends to be more flood-prone. The Lerma River, Mexico's second longest, runs through the region, and has produced several large floods in the last ten years, the biggest of which occurred in 2003. The selected municipalities of Panindicuaro and Penjamillo share a border in northern Bajío. Panindicuaro's communities of Exhacienda Curimeo (population 478) and Los Alvarado (population 226) were selected as field sites. In Penjamillo, San Jose (population 629) and La Cuestita (population 266) were chosen as study communities. Los Alvarado and La Cuestita are the more marginalized communities in this region.

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4 Ibid.

## Latin America Country Context

### Dominican Republic

#### Country Context

The Dominican Republic occupies 48,670 sq km or two-thirds of the island of Hispaniola in the Caribbean Sea. At over \$78 billion, the country claims the largest GDP in the Caribbean and Central America.<sup>1</sup>

However, the distribution of that wealth is vastly unequal. The UN Human Development Report ranks the Dominican Republic 90th in the world on income equality.<sup>2</sup> During the 2003 economic crisis, 62 percent of the country's 9 million people were living below the poverty line, and 33 percent were living in extreme poverty.<sup>3</sup>

#### Climate Variability

The Dominican Republic is located in the middle of the Atlantic hurricane belt. The island experiences average temperatures ranging from mid to high 20 degrees Celsius year-round. During the wet season from May to November, most areas receive 100-200mm of precipitation per month. The Dominican Republic is already experiencing impacts from climate change. The number of hotter-than-normal days per year has increased significantly since 1960, and temperatures have risen by .45 degrees Celsius. Models predict that temperatures will increase by another 1.1 to 3.6 degrees Celsius by 2090. Precipitation trends are also troubling. Rainfall has decreased at a rate of 4.5 percent per decade since 1960, and is expected to continue to decrease, especially in the wet months.<sup>4</sup>

Tropical storms are generally predicted to increase in intensity with climate change, but it is difficult to predict if this will hold true in the Dominican (in part because of the influence of El Niño/La Niña events). Stronger storms could create more floods and landslides in the Dominican Republic. The island nation is

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<sup>1</sup> CIA World Fact Book, Dominican Republic

<sup>2</sup> "Economy and Inequality." Human Development Report. United Nations Development Programme, 2009. Web. 4 Nov. 2009. <<http://hdrstats.undp.org/en/indicators/161.html>>.

<sup>3</sup> "República Dominicana." Análisis Común de País (2005). United Nations Development Group. Web. 4 Nov. 2009. <<http://www.undg.org/docs/8244/Analisis-Comun-de-Pa%EDs-RD.pdf>>.

<sup>4</sup> McSweeney, C., M. New, and G. Lizcano. "UNDP Climate Change Country Profiles: Dominican Republic." MS. 2008. Web. <<http://country-profiles.geog.ox.ac.uk/>>.

also susceptible to sea level rise. Models predict anywhere from a .13 meter to over half a meter rise by the 2090s.<sup>5</sup>

### **Vulnerability**

The Dominican Republic is vulnerable to climate hazards not just because of its geography, but also because of socioeconomic factors. Its severe income inequality means that while a small portion of the population will easily be able to make necessary adaptations, many of the Dominican people have few resources with which to fight climate change. Compounding the problem is the fact that two key sectors of the Dominican economy will be negatively impacted by climate change. Tourism is easily the country's biggest income source, but could be impacted by stronger storms, coastal erosion, ocean acidification, and sea level rise. Agriculture also remains an important part of the economy, and one that will be affected by changes in temperature and precipitation.<sup>6</sup>

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<sup>5</sup> McSweeney, C., M. New, and G. Lizcano. "UNDP Climate Change Country Profiles: Dominican Republic." MS. 2008. Web. <<http://country-profiles.geog.ox.ac.uk/>>.

<sup>6</sup> Plan de Acción de Adaptación al Cambio Climático en la República Dominicana. Rep. Santo Domingo: SEMARENA, 2008.



# Mexico

## Country Context

With an estimated population of 111 million, Mexico is the 11th most populous country in the world today.<sup>7</sup> Even though the contribution of agriculture in the GDP has been steadily declining (from 7% in 1980 to 3.6% in 2006) agriculture still employs considerable workforce (18% in 2003 most of whom practice subsistence agriculture).<sup>8</sup> The primary reason for this is the prevalence of the historic 'ejido' social system. The ejido is a social system where the government tries to promote the use of communal land for farming. It was an important component of the land reform program. Landless farmers who lease lands from wealthy landlords would petition the federal government for the creation of an ejido in their general area.

## Climate profile and vulnerability

Agriculture is highly vulnerable to weather extremes, in particular in the Northern parts of the country, where water scarcity is an issue, or the Southern parts of the country, where tropical storms result in extensive damage to crop and livestock production. Reducing vulnerability to climate change is of utmost importance in the agricultural sector in Mexico, considering the role the sector plays in food security and livelihoods of rural populations. During the past two decades, over 80 percent of the total economic losses from weather-related disasters occurred in the agricultural sector.<sup>9</sup> It has been predicted that northern areas and regions with large populations, especially in central Mexico, are most vulnerable to droughts and desertification, since erosion and drought severity will increase with higher temperatures and rainfall variations in these arid and semi arid regions. They are expected to receive even less than 50mm of rainfall monthly. Northern and Central regions are most vulnerable in the agricultural sector, as the continual farming of maize in these regions has a bleak future. El Nino and La Nina events can alter precipitation patterns significantly.<sup>10</sup> During some El Niño years, winter precipitation may be so great that stream flow and water levels in dams may exceed those observed during summer. In contrast, summer droughts during these events can lead to serious deficits in

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<sup>7</sup> Central Intelligence Agency, The World Fact book. Accessed on 29<sup>th</sup> October 2009.

<https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html#People>

<sup>8</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html#Econ>

<sup>9</sup> Comision Economica para America Latina y el Caribe. Accessed on 29<sup>th</sup> October.

<http://www.eclac.org/>

<sup>10</sup> US National Assessment of the potential Consequences of Climate variability and change. Accessed on 29<sup>th</sup> October, 2009. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/newsletter/1999.10/Mexico.html>

reservoir levels and in rain-fed maize production. In Mexico during 1997, the estimated costs of climate anomalies associated with El Niño were around 8 billion pesos (900 million US dollars), particularly in agricultural activities, when 2 million hectares were affected by a severe drought. In addition to the vulnerability of agricultural sector, the coastal lowlands of Mexico are vulnerable to sea level rise. The high poverty, heavy reliance on agriculture and potential risk to extreme events renders Mexico extremely vulnerable. The Ayuntamiento (Municipal government) in Mexico can play a potentially significant role in enabling adaptation. However, de facto decentralization in Mexico is ineffective since fiscal control and authority remains solely in the federal realm.<sup>11</sup> Also, the lack of local expertise is an endemic problem in Mexico and municipalities are seldom able to employ and retain qualified environmental, technical and social experts.<sup>12</sup>

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<sup>11</sup> Rodriguez, V. E., 1997, 'Decentralization in Mexico From Reforma Municipal to Solidaridad to Nuevo Federalismo', Westview Press.

<sup>12</sup> Assesto, V., Hajba, E., Mumme, S., 2003, ' Democratization, decentralization and local environmental policy capacity: Hungary and Mexico', The Social Science Journal, Vol. 40, pp: 249-268

## West Africa Country Context and Study Sites

### Niger

#### Country Overview

Niger has a population of 15 million and a land area of 1.264 million sq km. Niger is the least developed country based on the Human Development Index of 2007.<sup>1</sup> The GDP of the country is \$10.29 billion and the GDP per capita is \$273. Agriculture contributes to 27.9 percent of the GDP, with the primary crops including millet, sorghum, cowpeas, peanuts, cotton, and rice. Industry contributes to 10.5 percent of the GDP, including textile, cement, soap and beverage production.<sup>2</sup> The largest ethnic groups in Niger are the Hausa and Gourmantche, sedentary farmers who live in the arable, southern tier of the country. The remaining population is nomadic or semi-nomadic livestock-raising peoples.

#### Climate Profile

Niger is located in the Sahel region of West Africa and is composed of approximately two-thirds desert and mountains, and one-third savanna. The very northern part of Niger is desert and sparsely populated, moving south, the terrain transitions to rolling plains.<sup>3</sup> The climate is hot and dry throughout most of the country except for the extreme south, which experiences a more tropical climate.<sup>4</sup> The challenge of a shorter rainy season is exacerbated by a variable amount of rainfall from year to year and extreme droughts.<sup>5</sup> Inhabitants in the Sahel region experience the most climate uncertainty and four major droughts of the last century have occurred in this region.<sup>6</sup>

#### Vulnerabilities

Agricultural production, the dominant source of Niger's GDP, is threatened majorly by climatic variability. Production is further challenged by a low percentage of cultivatable land. The potential surface area for cultivation is 15 million hectares, which is less than 12 percent of the total area of the

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<sup>1</sup> CIA World Fact Book, <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>2</sup> US Department of State, Background Note: Niger, 2009; <http://www.state.gov/r/pa/ei/bgn/5474.htm>

<sup>3</sup> CIA world fact book, <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>4</sup> CIA world fact book, <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>5</sup> "Food Situation in the Sahel and West Africa." Sahel and West Africa Club. 2006.

<sup>6</sup> Ibid.

country.<sup>7</sup> Water supply is also limited, with the Niger River as the primary source; however, vulnerability to drought could be eased through access to ground water resources.<sup>8</sup> Population growth and more extreme climate variability will increase the vulnerability of the people of Niger.

#### Study Sites

Survey data collection in Niger focused on villages in administrative regions of Dosso and Maradi. Dosso is located in southwestern Niger and is the traditional home of the sedentary farmers known as the Zerma<sup>9</sup>. Unsurprisingly, sedentary livestock and subsistence agriculture dominate the economy in and around Dosso.<sup>10</sup> Sahelian farmers do not use irrigation to the same extent as farmers in other regions of Niger.<sup>11</sup>

The Maradi region also lies in the southern portion of Niger, and is located at the extreme northern edge of Niger's more Sahelian climate. Maradi's economy is more diverse than Dosso's, and is founded on the cultivation of groundnuts and cassava, artisan work (primarily leatherwork), and sheep and goat herding. The Hausa people – a group traditionally known as sedentary farmers and businessmen, dominate this region.

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<sup>7</sup> Convention Cadre des Nations Unies sur les Changements Climatiques, Cabinet du Premier Ministre, November 2000, p. 17; (Niger NAPA).

<sup>8</sup> Convention Cadre des Nations Unies sur les Changements Climatiques, Cabinet du Premier Ministre, November 2000, p. 17; (Niger NAPA).

<sup>9</sup> "**Niger**." *Encyclopædia Britannica. Encyclopædia Britannica Online*. Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-55021>>.

<sup>10</sup> "Dosso (Niger) -- Britannica Online Encyclopedia." *Encyclopedia - Britannica Online Encyclopedia*. Web. 01 Dec. 2009. <<http://www.britannica.com/EBchecked/topic/169756/Dosso>>.

<sup>11</sup> "**Maradi**." *Encyclopædia Britannica. Encyclopædia Britannica Online*. Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-9050729>>.

# Senegal

## Country Context

Senegal is a coastal country in West Africa comprised of 196,722 square kilometers. The population of Senegal is 13,711,597, growing at 2.7 percent. The majority of people live in rural areas, but urbanization is occurring at a rate 3.1 percent.<sup>12</sup> Senegal's GDP is \$21.78 billion which corresponds to a GDP per capita of \$1,600. The major contributors to the GDP include agriculture, industry and services. During the period from 1960 to 2003, agricultural productivity did not keep up with the pace of population and GDP growth, partly due to poor growing seasons and high variability in weather patterns. While Senegal's GDP slowly increased, agricultural GDP actually decreased, mostly due to drought and migration to urban areas.<sup>13</sup> While agriculture employs some 60 to 75% of Senegal's population<sup>14</sup>, it produces only 16% of its total GDP.<sup>15</sup>

The unique history and evolution of Senegalese property rights is important to understanding the foundation of the Senegalese agricultural sector. Under French rule, the idea of land ownership and private property was primarily restricted to the cities, while familial based property rights continued to dominate rural areas. Senegal's independence brought the establishment of three formal types of property rights: the private ownership introduced by the French (which remains concentrated in urban areas), public ownership (which is used to regulate economically and ecologically valuable areas), and common ownership – the dominant form of property rights in rural Senegal.<sup>16</sup> Marginalization, in terms of access, may make one group more vulnerable to climatic impacts, even at the community level.

## Climate Profile

Arable land accounts for just over 12 percent of total land area and covers a wide range of climate zones and soil types. Senegal's climate zones include the Sahelian north, which receives less than 300 mm of rainfall per year, the large Soudanian center, which receives 300-1000mm of rainfall per year, and the Guinean south, where rainfall isohyets are over 1000 mm.<sup>17</sup><sup>18</sup> The rainy season in Senegal occurs

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<sup>12</sup> CIA. "The World Factbook - Sénégal." <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>.

<sup>13</sup> Ibid.

<sup>14</sup> Mbadlo Ndiaye. *USDA Foreign Agricultural Service GAIN Report*, USDA, 2007. <http://www.fas.usda.gov/gainfiles/200701/146279961.pdf>.

<sup>15</sup> CIA. "The World Factbook - Sénégal." <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>.

<sup>16</sup> Faye, Jacques. *Land and decentralisation in Sénégal*. Rep. Le Hub Rural, 2008. 11-12

<sup>17</sup> Ministère de l'Environnement et de la protection de la nature. (2006). « Plan d'action national pour l'adaptation aux changements climatiques. » République du Sénégal.

between July and September. The amount of rain varies on a north-south gradient; the very north receives less than 100mm per month while the south can receive up to 200mm per month.<sup>19</sup> Rainfall is seasonally controlled by the movement of the tropical rain belt, known as the Inter-Tropical Convergence Zone, ITCZ, which transitions between the northern and southern tropics over the course of the year; affecting Senegal when it is in its northern position.<sup>20</sup> Variations in the latitudinal movement of the rain belt from year to year cause large inter-annual, and inter-decadal, variability in rainfall.<sup>21</sup> Temperature also varies among the regions of the country, generally increasing from the coast. However, during the rainy season, the south is cooler than the north due to the cooling influence of cloud and rainfall.<sup>22</sup> Rainfall in Senegal has been highly variable on an inter- and intra-annual basis for the past several decades. During the 1970s and 1980s, there were prolonged droughts that plagued the Sahel. Since 98% of Senegal's agriculture is rainfed, not irrigated, farmers are especially vulnerable in the arid central regions of Diourbel, Kaolack, Louga, and parts of Fatick, where there is little potential for irrigation.

### **Vulnerability**

Senegal's National Adaptation Plan of Action (NAPA) identifies the three most urgent areas of vulnerability as: water resources, the agricultural sector, and coastal zones. With drought and desertification representing a threat to rural livelihoods, all three are linked by loss of arable land, salinization, and negative impacts on livelihoods. Other issues of concern include reduction of rainfall, loss of woody plants, loss of grazing grasses, lower soil fertility, soil erosion, and the dependence on highly variable rainfall.

### **Study Sites**

Data collection in Senegal was concentrated in seven regions: Diourbel, Louga, Thiés, Kaffrine, Fatick, and Kaolack. 16 observations were collected in each of these, with the exception of the Kaffrine, where 32 observations were collected.

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<sup>18</sup> Sene, I. M., Diop, M., and Dieng, A. (2006). Impacts of Climate Change on the revenues and adaptation of farmers in Sénégal. CEEPA Discussion Paper number 20. Special Series on Climate Change and Agriculture in Sénégal.

<sup>19</sup> UNDP Climate Change Country Profiles. Accessed 5 November 2009. <http://country-profiles.geog.ox.ac.uk/index.html?country=Senegal&d1=Reports>

<sup>20</sup> UNDP Climate Change Country Profiles, p. 1. Accessed 5 November 2009. <http://country-profiles.geog.ox.ac.uk/index.html?country=Senegal&d1=Reports>

<sup>21</sup> UNDP Climate Change Country Profiles, p. 1. Accessed 5 November 2009. <http://country-profiles.geog.ox.ac.uk/index.html?country=Senegal&d1=Reports>

<sup>22</sup> UNDP Climate Change Country Profiles, p. 1. Accessed 5 November 2009. <http://country-profiles.geog.ox.ac.uk/index.html?country=Senegal&d1=Reports>

The Diourbel region is located in western Senegal and is a region known for groundnut, beverage, and perfume production. This region is home to the Grand Mosque of Touba, which draws pilgrims and has an active artisanal marketplace.<sup>23</sup>

Louga, a region located in northwestern Senegal, is predominately inhabited by the Fulani people, who are pastoral nomads, and the Wolof, who are traditionally sedentary farmers<sup>24</sup>.

The city of Thiés is located 35 miles to the east of Dakar, the capital of Senegal, and is the heart of the Thiés region. The city and regional proximity to the capital, as well as its location at the center of major transportation routes, has helped encourage the development of light industry, processing plants, and mining.<sup>25</sup>

The Senegalese region of Kaolack is in the west-central portion of the country. Its location on both the major railroad line and the coastline allows it to benefit from export trade of groundnuts and salt.<sup>26</sup>

Less information is available on the remaining regions. Based on maps, however, we know that the landlocked region of Kaffrine is located on Senegal's northern border with The Gambia, while Fatick forms part of Senegal's northern border with The Gambia and includes a stretch of coastline<sup>27</sup>.

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<sup>23</sup> **Diourbel.** " *Encyclopædia Britannica. Encyclopædia Britannica Online.* Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-9030568>>.

<sup>24</sup> **Louga.** " *Encyclopædia Britannica. Encyclopædia Britannica Online.* Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-9049043>>.

<sup>25</sup> **Thiès.** " *Encyclopædia Britannica. Encyclopædia Britannica Online.* Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-9072124>>.

<sup>26</sup> **Kaolack.** " *Encyclopædia Britannica. Encyclopædia Britannica Online.* Encyclopædia Britannica, 2009. Web. 1 Dec. 2009 <<http://search.eb.com.proxy.lib.umich.edu/eb/article-9044636>>.

<sup>27</sup> "Regions of Senegal: Facts, Discussion Forum, and Encyclopedia Article." *AbsoluteAstronomy.com.* Web. 01 Dec. 2009. <[http://www.absoluteastronomy.com/topics/Regions\\_of\\_Senegal](http://www.absoluteastronomy.com/topics/Regions_of_Senegal)>.



# Burkina Faso

## Country Context

Burkina Faso is a 274,000 square kilometer land locked country surrounded by six countries in West Africa. The estimated population is currently over 15 million people. The GDP of Burkina Faso is \$17.96 billion, corresponding to a GDP per capita of \$1,200. The country ranks poorly on the Human Development Index, at the sixth to last place.<sup>28</sup>

Burkina Faso has a history of informally recognizing and including its local level institutions in both governance and development. The national Decentralization Law of 1998 formally recognizes local level institutions as the base of rural development.<sup>29</sup> The law allows groups of villages to request district status from the government rather than the government delineating the district boundary and then allowing the population to select a leader.<sup>30</sup> The law also allows legal recognition of any local, federative, or community group.<sup>31</sup>

## Climate Profile

Climate variability is already a major constraint on food security and poverty reduction efforts due to the high dependence on the primary sector, which accounts for 86% GDP.<sup>32</sup> Droughts, floods, heat waves and dust storms are the major climatic hazards in Burkina Faso, and these contribute to problems such as desertification, land degradation and migration away from the central area of the country. Data presented in the NAPA, based on climate records extending to 1902 shows that the dry zone has been extending southwards during the last century. The length of the growing season varies from less than 60 days in the north to 160 days in the south, with large inter-annual variation.<sup>33</sup> There is a high level of uncertainty associated with climate projections for Burkina Faso. Downscaled climate data from 8 models for Dori, Ougadougou and Bobo-Dioulasso emphasize the uncertainty in precipitation

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<sup>28</sup> Human Development Report 2009, UNDP.

[http://hdr.undp.org/en/media/HDR\\_2009\\_EN\\_Complete.pdf](http://hdr.undp.org/en/media/HDR_2009_EN_Complete.pdf)

<sup>29</sup> Roark, Paula et al. "Can Local Institutions Reduce Poverty?" Environmental and Social Development Unit, Africa Region. September 2001. p. 1.

<sup>30</sup> Roark, Paula et al. "Can Local Institutions Reduce Poverty?" Environmental and Social Development Unit, Africa Region. September 2001. p. 1.

<sup>31</sup> Roark, Paula et al. "Can Local Institutions Reduce Poverty?" Environmental and Social Development Unit, Africa Region. September 2001. p. 1.

<sup>32</sup> International Monetary Fund, Accessed on 1<sup>st</sup> November 2009

<http://www.imf.org/external/pubs/ft/weo/2009/02/weodata/weorept.aspx?sy=2006&ey=2009&scsm=1&ssd=1&sort=country&ds=.&br=1&c=748&s=NGDPD%2CNGDPDPC%2CPPPGDP%2CPPPPC%2CLP&grp=0&a=&pr.x=88&pr.y=0>

<sup>33</sup> Africa Renewal, United Nations. Accessed on 1<sup>st</sup> November 2009

<http://www.un.org/ecosocdev/geninfo/afrec/newrels/climate-change-3.html>

projections. The projections show that average maximum temperatures will increase in the range of 2-3C by 2050 but that the only robust results for precipitation are indications that there will be an increase in rainfall towards the end of the rainy season in Ougadougou and Bobo-Dioulasso. Climate change is expected to increase variability and the incidence of extreme weather events, such as droughts, floods and intense rainfall events

### **Vulnerability**

These extreme weather events can be expected to impact negatively on crop production, in particular; agriculture is already vulnerable to current fluctuations in climate in many areas of Burkina Faso. Increasing temperatures will cause greater evapo-transpiration, which will lead to drier soil conditions in many areas, and as demand grows water availability is likely decrease regardless of whether there is an increase or decrease in precipitation. An increase in maximum temperatures, and probable increase in drought conditions, will affect pastoralist activities both by contributing to land degradation and by directly impacting the herd mortality rates.<sup>34</sup> In this respect it is also worth noting that climate change is increasingly meaning that for nomadic or semi-nomadic groups traditional indicators used to inform their movements are no longer reliable. It can be expected that an increase in extreme temperatures will increase heat-related mortality, and that extreme events such as heavy rainfall and floods will increase the incidence of diarrheal diseases. Indirectly, if subsistence activities such as agriculture and ranching are negatively affected by changes in climate, then the overall health of the population will be affected due to decreased food security and ability to gain enough nutrients.

### **Burkina Faso**

Burkina Faso's survey data was collected from three separate regions. These regions represent high, moderate, and low historic levels of climate hazard exposure, as described by local team leadership. The provinces in which data was collected are: Boucle du Mouhoun, Soum, Bazega, Kouritenga, Zoundweogo, and Plateau-Central.

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<sup>34</sup> Climate change and African agriculture, Policy Note 36, CEEPA. Accessed on 1<sup>st</sup> November 2009. <http://www.ceepa.co.za/docs/POLICY%20NOTE%2036.pdf>

## Dominican Republic Household Survey Questionnaire

<b>Name of Municipality</b>	<b>Name of Community</b>	<b>Person interviewed</b>
	<b>Interview Number</b>	<b>Interviewer</b>
Gender	<b>Head of household</b>	

### 1. Family History/Background

<b>Years lived in the community</b>	<b>Have you always lived in the community</b>	<b>Previous place of residence</b>

### 2. Size of household (number of persons)

	<b>Age&lt;15</b>	<b>Age 15-60</b>	<b>Age&gt;60</b>
Size of nuclear family			
Members of the household (permanent residents that are family or otherwise)			

### 3. Education (for members over 15)

Members of household	Know how to read or write	Elementary Education		High School		Technical education		University	
		Complete	Incomplete	Complete	Incomplete	Complete	Incomplete	Complete	incomplete
15-26 years old									
Over 26									

### 4. Health (Number of occurrences of illness in the household)

Time	Sickness	Men (>15 - <60)	Women (>15 - <60)	Children (<15)	Monthly medical expenses	Time taken off of work
In the last 2 years	Diarrea					
	Dengue					
	Malaria					
	Respiratory illness					
	Skin disease					
	Conjuntivitis					
	Parasites					
3-5 years ago	Diarrea					
	Dengue					
	Malaria					
	Respiratory illness					
	Skin Disease					
	Conjuntivitis					
	Parasites					
More than 5 years	Diarrea					
	Dengue					
	Malaria					
	Respiratory Illness					
	Skin Disease					
	Conjuntivitis					
	Parasites					

### 5. Animals (number)

Type	Last year (2008)						Past 10 years					
	Stabled		Pastured within the community		Migratory (mobile)		Stabled		Pastured within the community		Migratory	
	No.	Months/year	No.	Mo./year	No.	Mo./year	No.	Mo./year	No.	Mo./year	No.	Mo./year
Cattle												
Goats/sheep												
Horses/mules/donkeys												
Pigs												

**6. Regular household income in 2008 (total income for the household)**

Source of income	Amount in 2008 (RD\$)	Income trends in the last 10years (mark the one that applies)		
		Increase	Stay the same	Decrease
Agriculture				
Fishing				
Livestock				
Forest products				
Salary				
Day labor				
Pension				
Commerical				
Remittances				
Trabajo por cuenta propia				
Other				
Other				
Other				

**7. Primary Livelihood (ie. Fishing, agricultura, livestock, how much land do you own, how many houses, what are your assets? etc....)**

Time	Asset/activity:		Asset/activity:		Asset/activity:		Asset/activity:	
	Quantity	Use	Quantity	Use	Quantity	Use	Quantity	Use

In the last 10 years								
More than 10 years ago								

Time	Asset/activity:		Asset/activity:		Asset/activity:		Asset/activity:	
	Quantity	Use	Quantity	Use	Quantity	Use	Quantity	Use
In the last 10 years								
More than 10 years ago								

**Examples of use: agriculture, fishing, ranching etc...**

**8. Sources of information regarding climate and weather (mark yes for responses)**

Source	Type of information				
	Agriculture	Market	Transport	Services	Help
Radio					
Television					
Written press					
Local residents					
Government extension/official					
Private extension					
Market actors					
Other (specify)					

**9. Climate risks and impact on the household (hurricanes, tornadoes, flooding etc...)**

Time	Type of risk:		Type of risk:		Type of risk:		Type of risk:	
	No.	Impact	No.	Impact	No.	Impact	No.	Impact

In the last 10 years								
More than 10 years ago								

Time	Type of risk:		Type of risk:		Type of risk:		Type of risk:	
	No.	Impact	No.	Impact	No.	Impact	No.	Impact
In the last 10 years								
More than 10 years ago								

**10. ¿How have these risks affected your capacity to earn a living? (mark yes for correspondence)**

Effect	Short term (6 months)	Long term (more tan 6 months)
Loss of a household member		
Loss of land		
Loss of crops		
Death of animals		
Loss of stored food		
Loss of equipment (machines, tractor, boat etc)		
Loss of employment		
Loss of transportation (impassable roads etc)		
Loss of Bussiness		
Loss of credit		
Other		

**11. ¿How have your social and cultural relations within the community been affected by these events?**

- Has someone in your household lost membership to a group, association or cooperative
- Has someone in your household been in conflict with a group, association or cooperative
- Changed the power dynamic in your household
- Someone left the household?
- Lost ability to attend celebrations, parties, special events
- New contact with authorities
- Formation of a new group, formal or informal
- Other (specify) \_\_\_\_\_

**12. ¿What or who has helped you the most to deal with problems associated with climate events? (name three principle groups)**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



**13. Primary adaptation strategy for the household (climate risks as indicated above)**

Type of adaptation strategy	Why it was selected Prevention (1) Response (2)	Impact on the household (5:high positive, 4:positive, 3:neutral, 2:negative, 1:very negative)			
		Form of livelihood	Equity within the household	Value of the different members of the household	Effects on the environment
<b>Mobility</b>					
Of animals					
For employment					
To live					
Other infrastructure					
To study					
Migration outside of community					
<b>Diversification</b>					
New productive activities					
Varied crops or animals					
New forms of production					
New labor					
Learning a new trade					
Varied consumption					
<b>Storage</b>					
foods					
Seed					
Water					
<b>Communal Pooling</b>					
Final products					
Construction of dwellings					
Building infrastructure					
Preparation and prevention					
Social security					
Money transfers					
Non-monetary transfers					
<b>Markets</b>					
Credit					
Loan					
Savings					
Venta no planificada					
Compra no planificada					
Change type of employment					
<b>Other (specify)</b>					

Type and cost of investment your household made to deal with the climate risks

Type of investment	Why you selected? prevention (1) response (2)	Collectively(1) Individual(2)	Market price of the investment

**14. Cooperation among households ( work days in the last year)**

	Last year	Trends in the last 10 years		
		Increased	Stayed same	Decreased
Forests				
Agriculture				
Construction				
Cultural				

**15. Does a member of your household belong to any groups or associations?  
(formal or informal)**

Name of group	Type of group (production etc)	Since when have you belonged? (year)

**16. Do any members of your household have Access to any of the following climate change institutions? (Yes=1 y No= 0)**

Institution	Access (yes/no)	Number of times per year? (Number)	Does the institution have leadership in the community (yes/no)
<b>Públicas</b>			
Secretary of Environment & Natural Resources			
Secretary of Agriculture			
Secretary of Public Health and Social Assistance			
Secretary of Education			
Municipal Government			
Dominican Agrarian Institute			
National Institute of Water Resources			
<b>Civiles</b>			
Firefighters			
Red Cross			
Civil Defense			
NGO (Specify)			
Irrigation Group (specify name)			
Agricultural cooperatives (specify name)			
Milk cooperatives (specify name)			
<b>Market</b>			
Private Banks			
Agricultural Bank			
Market institution			
<b>International organizations (specify name)</b>			
Other (describe)			



# Encuesta a Hogares Rurales de Adaptación Local al Cambio Climático (ENHRALCC)

Mexico Household questionnaire  
Formulario 2



MÓDULO DE ACTIVO 0. APLIQUÉ AL FINAL DE LA ENTREVISTA

(COMPLETE AT END OF INTERVIEW)

1		2		3		4		5		6		7	
MATERIAL OF THE HOUSE'S WALLS		MATERIAL OF THE HOUSE'S FLOOR		MATERIAL OF THE HOUSE'S ROOF		DOES THE HOUSE GET WATER?		DOES THE HOUSE HAVE SEWAGE		HOW OFTEN DOES THE HOUSE GET WATER		IS THERE ELECTRIC LIGHT	
	MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO		MARQUE UN SOLO CIRCULO
¿De qué material es la mayor parte de los muros o paredes de su casa?		¿De qué material es la mayor parte del piso de su casa?		¿De qué material es la mayor parte del techo de su casa?		¿En esta casa tienen agua?		¿Esta casa tiene drenaje/de sagüe?		¿Cada cuándo llega el agua a su casa?		¿Tiene luz eléctrica?	
Material de deshecho	01	Tierra	01	Material de deshecho	01	Entubada	01	NO	01	Un día a la semana	01	SI	01
Lámina de cartón	02	Cemento o firme	02	Lámina de cartón	02	una pipa	06	SÍ	02	Dos días a la semana	02	NO	02
Lámina metálica o de asbesto	03	Loseta, linóleum, mosaico, mármol	03	Lámina metálica o de asbesto	03	un pozo	07			Tres días a la semana	03		
Madera o tejamanil	04	Madera, duela o parquet	04	Madera o tejamanil	04	un río, arroyo o lago	08			Cuatro días a la semana	04		
adobe, bajareque o embarro	05	Alfombra	05	Terrado con viguería	05	Otro	05			Cinco días a la semana	05		
Multipanel o panel	06			Teja	06					Seis días a la semana	06		
Tabique, ladrillo, tabicón, block	07			Losa de concreto sólida o con tabique,	07					Diario algunas horas al día	07		
Piedra o cantera	08			Otro	08					Diario durante todo el día	08		
Concreto	09												

**DOES HOUSE HAVE A LATRINE ROOMS IN THE HOUSE**

**8** ¿Su casa cuenta con excusado, retrete, sanitario, letrina u hoyo negro? 1=SÍ; 2= NO

**9** ¿Cuántos cuartos tiene en total su casa contando la cocina (no cuente baños ni pasillo)?

ANOTE CÓDIGO
ANOTE NÚMERO

HOUSE IS RENTED, OWNED, ETC

**10**

¿Su casa es.....?1.rentada o alquilada; 2. prestada; 3. la están pagando; 4. es propietario (a) 5. Otra

ANOTE CÓDIGO
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**MÓDULO 2: ACTIVOS**

**ASSETS**

**A. ACTIVOS DEL HOGAR**

**HOUSEHOLD ASSETS**

**DOES THE HOUSEHOLD HAVE...**

**YES/NO**

**HOW MANY?**

**YES/NO IN 2008**

**HOW**

**MANY IN 2008**

COD	¿En 2002/2004, este hogar contaba con ... LEA OPCIONES	1	2	3	4
		NO=1 SÍ=2 ANOTE CÓDIGO	¿Cuántas unidades? ANOTE NÚMERO	En 2008 tenían.. LEA OPCIONES Y ANOTE CÓDIGO NO=1 SÍ=2	¿Cuántas unidades? ANOTE NÚMERO
01	línea telefónica fija?				
02	teléfono móvil o celular o radio?				
03	televisión por cable, SKY o DIRECTV, Multivisión?				
04	internet?				
05	estéreo, modular, minicomponente o consola,				
06	televisión a color?				
07	DVD (reproductor de discos de video)?				
08	computadora?				

PHONE LINE

CELLULAR PHONE

CABLE TV

INTERNET

RADIO

COLOR TV

DVD

COMPUTER

**B. OTROS ACTIVOS DEL HOGAR**

**OTHER HOUSEHOLD ASSETS**

**DID THE HOUSEHOLD OWN, RENT, OR SHARE...**

**YES/NO**

**HOW MANY?**

**YES/NO IN 2008**

**HOW MANY IN 2008**

COD	ACTIVO	5	6	7	8
		NO=1, SÍ=2 ANOTE CÓDIGO	¿Cuántas unidades? ANOTE NÚMERO	En 2008 tenían.. LEA OPCIONES COLUMNA 5 ANOTE CÓDIGO	¿Cuántas unidades? ANOTE NÚMERO
	¿Usted o algún miembro del hogar tuvieron en 2002/2004, ya sea propio, prestado, o en sociedad con otros hogares, algún LISTE OPCIONES?				
01	Auto particular				
02	Camioneta o camión				
03	Tractor				
04	Arado				
05	Molino de nixtamal				
06	Otras casas o departamento además de ésta				
07	Terreno				
08	Bomba de agua				
09	otros especifique				
10					
11					

AUTOMOBILE

TRUCK

TRACTOR

PLOW

MILL FOR TORTILLA DOUGH

OTHER HOUSES

LAND

IRRIGATION EQUIPMENT

OTHER

**MÓDULO 2: ACTIVOS**

**2C ACTIVOS AGRICOLAS ANTES DEL EVENTO Y EN 2008  
LAND IN 2002/2004**

Ahora le vamos a preguntar por su tierra en 2002/2004

1	DID THE HOUSEHOLD HAVE ACCESS TO LAND, YOUR OWN OR RENTED NUMBER OF HECTARES		2002/2004
	COD		HA
2	01	ejidal EDIJO	
	02	comunal o posesionario COMMUNAL	
	03	privada PRIVATE	
	04	prestada LOANED	
	05	en aparcería o rentada PARTNERSHIP	
	06	Otros especifique OTHER	
3	De la superficie total, cuánto fue (LEA OPCIONES)		
	COD		
	01	en zonas bajas LOW LANDS	
	02	en zonas altas HIGH LANDS	
	03	es cerril FALLOW	

ANOTE  
CÓDIGO

4 ¿En 2002/2004 tuvo problemas de erosión en su tierra agrícola? NO=1 Sí=2

5 En 2002/2004 su tierra fue fértil? NO=1 Sí=2

**AG ASSETS  
LAND IN 2008**

Ahora le vamos a preguntar por su tierra en 2008

12	DID THE HOUSEHOLD HAVE ACCESS TO LAND, YOUR OWN OR RENTED NUMBER OF HECTARES		2008
	COD		HA
13	01	ejidal EDIJO	
	02	comunal o posesionario COMMUNAL	
	03	privada PRIVATE	
	04	prestada LOANED	
	05	en aparcería o rentada PARTNERSHIP	
	06	Otros especifique OTHER	
14	De la superficie total, cuánto fue		
	COD		
	01	en zonas bajas LOW LANDS	
	02	en zonas altas HIGH LANDS	
	03	es cerril FALLOW	

CÓDIG  
O

15 ¿En 2008 tuvo problemas de erosión en su tierra agrícola? NO=1 Sí=2

16 En 2008 su tierra fue fértil? NO=1 Sí=2

6	De esa superficie total, ¿cuánta fue de (LEA OPCIONES) HOW MUCH LAND...		
	COD		
	01	temporal? TEMPORAL	
	02	riego? IRRIGATED	
7	El agua para riego provino de IRRIGATED WATER CAME FROM...		ANOTE CÓDIGO
	COD		
	01	Bordo, hoyo de agua o jaguey? POOL	
	02	Pozo profundo?	
	03	Pozo a cielo abierto? OPEN AIR WELL	
	04	Un río? RIVER	
	05	Un manantial? SPRING	
	06	Una presa? DAM	
07	Otra fuente OTHER		

ANOTE  
CÓDIGO

**QUESTIONS ABOUT WATER USE**

¿En 2002/2004 tuvo Ud. problemas de abastecimiento de agua en su parcela(s)? NO=1 Sí=2

¿Ud. en 2002/2004 vendió o compro agua para su parcela? (incluyendo pago de cuotas) NO=1 Sí=2

¿En 2002/2004 tuvo problemas (conflictos) por el uso de agua? NO=1 Sí=2

¿En 2002/2004, consideró que estuvo bien distribuida el agua entre los usuarios de la

17	De esa superficie total, ¿cuánta fue de (LEA OPCIONES) HOW MUCH LAND...		
	COD		
	01	temporal? TEMPORAL	
	02	riego? IRRIGATED	
18	El agua para riego provino de IRRIGATED WATER CAME FROM...		ANOTE CÓDIGO
	COD		
	01	Bordo, hoyo de agua o jaguey? POOL	
	02	Pozo profundo?	
	03	Pozo a cielo abierto? OPEN AIR WELL	
	04	Un río? RIVER	
	05	Un manantial? SPRING	
	06	Una presa? DAM	
07	Otra fuente OTHER		

ANOTE  
CÓDIG  
O

**QUESTIONS ABOUT WATER USE**

¿En 2008 tuvo Ud. problemas de abastecimiento de agua? NO=1 Sí=2

¿Ud. en 2008 vendió o compro agua? NO=1 Sí=2

¿En 2008 tuvo problemas (conflictos) por el uso de agua? NO=1 Sí=2

¿En 2002/2004, consideró que estuvo bien distribuida el agua entre los usuarios? NO=1

**Ahora le vamos a preguntar sobre el cultivo principal que usted sembró en 2002/2004**

23	Nombre del Cultivo	
24	¿Hace cuántos años siembra este cultivo? ANOTE AÑOS	
25	¿Cuál es su producción en un año bueno? ANOTE TONELADAS/HA	
26	¿Cuál es su producción en un año malo? ANOTE TONELADAS/HA	
27	¿Qué tipo de semilla usa? Criollo=1; Mejorado=2; Certificado=3; Apto para siembra=4	
28	En 2002/2004 que tipo de semilla sembró? Criollo=1; Mejorado=2; Certificado=3; Apto para siembra=4	
29	En su localidad, ¿cuál es el cultivo que genera mayores ganancias? (altos precios de venta, o bajos costos de producción)	
30	¿Lo cultivan? No=1; Sí=2	
31	SI NO LO CULTIVA: ¿Por qué no lo cultiva?	ANOTE CÓDIGO
	01 No conoce del manejo de ese cultivo	
	02 No cuenta con dinero suficiente	
	03 Suelos no apropiados	
	04 Demora mucho en cosechar	
	05 Otros ¿cuál? _____	

CÓDIGO

**QUESTIONS ABOUT PRINCIPAL CROPS**

NAME OF CROP

CROP?

WHAT'S YOUR PRODUCTION IN A GOOD YEAR?

WHAT'S YOUR PRODUCTION IN A BAD YEAR?

WHAT TYPE OF SEED DO YOU USE?

WHAT TYPE OF SEED WAS PLANTED IN 2002/2004?

IN YOUR AREA, WHICH CROP GENERATES THE MOST PROFITS DO YOU GROW IT?

IF YOU DON'T GROW IT, WHY NOT?

DON'T KNOW HOW TO MANAGE IT

NOT ENOUGH MONEY

INAPPROPRIATE SOILS

TAKES TOO LONG TO GROW IT

OTHER

LIVESTOCK ASSETS

C. ACTIVOS GANADEROS ANTES DEL EVENTO Y EN 2008 E INGRESOS GANADERIA

	HOW MANY ANIMALS	HOW MANY SOLD	HOW MANY EATEN	HOW MANY DIED OR STOLEN			
	1	2	3	4	5	6	7
	¿Cuántos animales tenía (LEA OPCIONES) en el 2002/2004? 999= NO RECUERDA, SI RECUERDA SIGA PREGUNTANDO	ANIMALES 2002/2004	¿Cuántos animales tenía en el 2008? SI NO TENÍA PASAR AL MÓDULO 3	¿Cuántos vendió en 2008?	¿A cuánto los vendió?	¿Cuántos animales se comieron en casa? (de los propios)	¿Cuántos murieron o le robaron?
COD	ANOTE NÚMERO		ANOTE PESOS	ANOTE NÚMERO			
01	Becerras						
02	Novillos y novillonas						
03	Bueyes/Toros						
04	Vacas						
05	Caballos						
06	Burros/Mulas						
07	Cabras o chivos						
08	Borregos						
09	Guajolotes						
10	Gallinas, gallos y pollos						

CALVES

COSTOS DE PRODUCCIÓN

COSTS OF PRODUCTION

OXEN/BULLS

¿Cuánto gasto en 2008 en alimentos, vacunas, veterinario en sus animales?

ANOTE PESOS

COWS

HORSES

NOTA ENCUESTADOR

DONKEYS/MULES

GOATES

LAMBS

TURKEYS

CHICKENS

COSTS OF MEDICINE, VETERINARY BILLS

ALIMENTO QUE COMPRÓ	Al mes	Número de veces al año	Total 2008
MEDICINAS			
VETERINARIO			

MODULO 3: CRÉDITOS Y SEGUROS

Le vamos a preguntar sobre 2002/2004 al 2008

HAS THE HOUSEHOLD ASKED FOR LOANED MONEY OR CREDIT?

A. CRÉDITOS

1	Desde el 2002/2004 a 2008, usted u otro miembro de este hogar tuvo que pedir un dinero prestado o un crédito? No=1/Sí=2 ANOTE CÓDIGO SI RESPONDE "NO" PASE A PREGUNTA 3	
---	---	--

Si ha solicitado crédito:

2	¿A quién o quienes solicitarón dicho préstamo en (LEA OPCIONES)?	¿En qué año?
COD		ANOTE AÑO
01	Banca comercial	
02	una SOFOL	
03	una unión de crédito	
04	financiera rural	
05	prestamista local	
06	Caja popular	
07	Caja solidaria	
08	Proveedores de insumos (fertilizantes, semilla, plantas)	
09	acopiador, comercializador)	
10	la familia	
11	vecinos de la localidad	

WHO HAVE YOU ASKED?

BANK

CREDIT UNION

RURAL FINANCIER

LOCAL LOANER

AG PROVIDER

COMMERCIAL AGENT

FAMILY

NEIGHBORS

3	Si no ha solicitado créditos: ¿Por qué razón no solicitó un préstamo o un crédito? 1=no lo necesitaba; 2= por la tasa de interés; 3= piensa que no le darán el crédito; 4= Otra	
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CREDIT & INSURANCE

HAS THE HOUSEHOLD GOTTEN INSURANCE?

B. SEGURO

4	Desde el 2002/2004 a 2008, usted u otro miembro de este hogar ha contratado algún seguro? No=1/sí=2 ANOTE CÓDIGO. SI RESPONDE "NO", PASE A MODULO 4	
---	---	--

Si ha contratado seguros

5	¿Qué tipo de seguros fue (LEA OPCIONES)?	¿cuando? ULTIMO AÑO
COD		
01	Vehículo	
02	Casa o departamento	
03	Gastos médicos mayores	
04	Agropecuario	
05	Otro	

WHAT TYPE OF INSURANCE

VEHICLE

HOME

MEDICAL

AG

OTHER

6 El año de la inundación/sequía del 2003/2004, tenía asegurada su producción? NO=1, SI=2

DID YOU HAVE PRODUCTION INSURANCE DURING THE FLOOD/DROUGHT OF 2003/2004?

SI NO TENIA SEGURO PASE A MÓDULO 4

7 ¿Qué cultivo tenía asegurado?

WHAT CROP DID YOU HAVE INSURED?

8 ¿Qué superficie tenía asegurada?

HOW MUCH LAND WAS INSURED?

9 ¿Recibió el pago por ese seguro? NO=1, SI=2

DID YOU RECEIVE A PAYMENT?



**MODULO 4: INGRESOS MONETARIOS Y NO MONETARIOS**

ANOTE EL CÓDIGO DE LOS MIEMBROS DEL HOGAR QUE TRABAJARON EN 2008 DE ACUERDO A LA INDICADO EN LA PREGUNTA 8 DEL MÓDULO 1

4.A TRABAJO ASALARIADO **SALARIED WORK**

**MONETARY & NONMONETARY INCOME**

4B. TRABAJADOR POR SU CUENTA SECTOR SERVICIOS E INDUSTRIA

**SELF EMPLOYED WORK**

Ahora le vamos a preguntar por el sueldo /salario de (MENCIONE A NOMBRE)

**HOW MUCH WAS**

**RECEIVED PER MONTH**

**# OF MONTHS**

**RECEIVED OTHER TYPE OF PAY?**

**HOW MUCH IN TOTAL?**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>ANOTE CODIGO MIEMBRO DEL HOGAR</b>	¿Cuánto recibió en promedio al mes en 2008 (MENCIONE NOMBRE DEL MIEMBRO DEL HOGAR)? ANOTE PESOS	N° de meses que recibió esa cantidad  ANOTE NÚMERO	En 2008, recibió (MENCIONE NOMBRE) gratificaciones, aguinaldos y/u otro tipo de pago en dinero adicional (tiempo extra, liquidación por contratos temporales), ANOTÉ CÓDIGO	¿Cuánto recibió en total de ese aguinaldo o pago extra en el 2008? ANOTE PESOS

**WHAT TYPE OF BUSINESS DID YOU HAVE**

**HOW MUCH WAS SOLD**

**HOW MUCH WAS SPENT TO SELL THOSE PRODUCTS**

**WHAT PROFITS DID THE BUSINESS RECEIVE**

	<b>5</b>	<b>6</b>				<b>7</b>				<b>8</b>			
<b>ANOTE CODIGO DEL MIEMBRO DEL HOGAR</b>	¿Qué tipo de negocio tenía (MENCIONE NOMBRE DEL MIEMBRO DEL HOGAR) en 2008?  1= Tienda; 2=Papelería 3= Tortillería 4= Taller mecánico o refaccionarias 5= Taller artesanal 6= Carpintería 7= Ofebrería 8= Elaboración de alimentos derivados de la ganadería, ejemplo quesos y leche 9=Otro especifique:	¿Cuánto vendió en promedio en 2008? PREGUNTE FRECUENCIA DE NO RECORDAR EL INFORMANTE				¿Cuánto gasto por la compra de éstos productos para su reventa/ o para elaborar (MENCIONE PRODUCTO EJEM QUESOS) que usted hace para la venta en promedio en 2008? PREGUNTE FRECUENCIA DE NO RECORDAR EL INFORMANTE				¿Cuántos ingresos recibió por la venta de éstos productos ó ganancia en promedio en 2008 ? PREGUNTE FRECUENCIA DE NO RECORDAR EL INFORMANTE			
		DÍA	SEM	MES	TOTAL	DÍA	SEM	MES	TOTAL	DÍA	SEM	MES	TOTAL
	ANOTE CODIGO DEL NEGOCIO O SERVICIO												

NOTAS ENCUESTADOR

SUELDO/SALARIO	MONTO	TOTAL
SEMANA		X 52=
QUINCENA		X 24=
MES		X 12=
OTRO (ANOTE PERIODO DE TIEMPO)		

SUELDO/SALARIO	MONTO	TOTAL
DÍA		X 360=
SEMANA		X 52=
QUINCENA		X 24=
MES		X 12=
OTRO (ANOTE PERIODO DE TIEMPO)		

**MODULO 4: INGRESOS MONETARIOS Y NO MONETARIOS**

**MONETARY & NONMONETARY INCOME**

ANOTE EL CÓDIGO DE LOS MIEMBROS DEL HOGAR QUE TRABAJARON EN 2008 DE ACUERDO A LA INDICADO EN LA PREGUNTA 8 DEL MÓDULO 1

**4C. INGRESOS AGRÍCOLAS**

**DESTINATION OF PRODUCTION**

**EAST  
PAYMENT  
TERMS FOR  
SUPPLIES?**

	DID YOU GROW CROPS?	WHICH CROPS?	HECTARES PLANTED	TONS HARVESTED	HOUSEHOLD CONSUMPTION	ANIMAL CONSUMPTION	SOLD	PRICE PER TON						
	1	2	3	4	5	6	7	8	9	10	11	12	13	
					¿Cuánta de su producción destinó a									
<b>ANOTE CODIGO</b>	Obtuvo producción agrícola en el año 2008? NO=1; SI=2 <b>SI LA RESPUESTA ES NO PASE A MODULO 5</b>	¿Qué cultivos?	HECTÁREAS SEMBRADAS	TONELADAS COSECHADAS	<b>CONSUMO HOGAR (anual)</b>	¿Cuanto hubiera gastado si hubiera tenido que comprarlo? (anual)	<b>CONSUMO ANIMAL (anual)</b>	¿Cuanto hubiera gastado si hubiera tenido que comprarlo? (anual)	<b>VENTA (anual)</b>	¿Tenía contrato para la venta de su producción? <b>NO=1; SI=2</b>	Si vendió en 2008, cual fue su precio de venta por tonelada	¿Cuánto gastó en la producción del cultivo? <b>USAR TABLA DE CALCULOS</b>	¿Recibe facilidades para la compra de los insumos para esta cultivo? NO=1; SI=2	
	ANOTE CÓDIGO	ANOTE CÓDIGO			ANOTE TONELADAS	ANOTE PESOS	ANOTE TONELADAS	ANOTE PESOS	ANOTE TONELADAS		ANOTE PESOS	ANOTE PESOS		

**CÓDIGOS CULTIVOS**

1=Maíz, 2= Fresa, 3= Trigo, 4=Zarzamora, 5=Rastrojo; 6=Sorgo; 7=Frijol, 8=Cebolla; 9=Jitomate; 10=Janamargo; 11=Garbanzo; 13=Canola; 14=Ajonjolí; 15=Otro (Especifique)

**4D. OTRAS TRANSFERENCIAS**

**OTHER TRANSACTIONS**

**DID  
HOUSEHOLD  
RECEIVE  
REMITTANCES?**

**HOW  
MANY  
TIMES WAS  
MONEY  
SENT?**

**HOW MUCH WAS SENT EACH TIME?**

REMESAS

**1** ¿Recibió usted. O algún miembro del hogar remesas durante

**2** ¿Cuántas veces le mandaron dinero en 2008? (n° meses)

**3** ¿ En promedio cuánto le mandaron cada vez? (USD)

**FROM WHERE WAS MONEY RECEIVED?**

**4** De dónde recibió los dineros

1=EUA	ANOTE CODIGO
2=Otra parte del país	
3=Otro	

**WHAT WAS PRINCIPAL SOURCE OF INCOME?**

**5** En 2002/2004 de dónde venía el principal ingreso de su hogar? Trabajo asalariado=1, Negocios propios=2, Agricultura y ganadería=3, Otros=4

**MÓDULO 5: INFORMACIÓN COMPLEMENTARIA** INFORMATION  
SOURCES OF CLIMATE INFORMATION

5A. FUENTES DE INFORMACIÓN DEL CLIMA

A través de que medio (LISTE OPCIONES EN FILA ) usted se informa de( lea opciones en columna de...?)				
		1	2	3
<b>COD</b>	A través de....	Clima	Precios de productos agrícolas	Apoyos de gobierno
01	Radio o televisión	01		
02	Prensa escrita	02		
03	Familiares o la comunidad	03		
04	Información del gobierno	04		
05	Proveedores de insumos	05		
06	Intermediarios/acaparadores	06		
07	Otros Especifique:	07		

DID YOU RECEIVE INFO FROM...

RADIO/TV  
WRITTEN PRESS  
COMMUNITY  
GOVERNMENT  
SUPPLIERS  
INTERMEDIARIES  
OTHER

CLIMATE EVENTS IN THE COMMUNITY

5B. Eventos climatológicos en la comunidad

WHICH EVENTS OCCURRED IN LAST 10 YEARS WHICH AFFECTED YOU MOST ARE THEY INCREASING, DECREASING, SAME HOW MANY TIMES

	4	5	6
4	¿Qué eventos han afectado a su hogar en los últimos 10 años?	¿Cuál de estos eventos le afectó más? LEA OPCIONES COLUMA	¿Cuántas veces? (incluidos los eventos de inundación/sequía del 2003/2005)
<b>CIRCULE C</b>		MARQUE CON UN CÍRCULO	ANOTE NÚMERO
	Sequías	01	
	Inundaciones	02	
01	Tormentas o trombas	03	
02	Granizadas	04	
03	Heladas	05	
04	Otros	06	

DROUGHT  
FLOOD  
STORMS  
HAILSTORMS  
FROST  
OTHER

**MODULO 6: EFECTOS DEL EVENTO** EFFECTS OF EVENTS

6A: EFECTOS DEL EVENTO GANADERIA WERE ANIMALS AFFECTED BY CLIMATE EVENT

1 ¿Se afectaron sus animales con la inundación/sequía ? NO=1/SÍ/2

Cod

SI RESPONDE "NO" PASE A LA PREGUNTA 6B

	2	3
De los animales afectados, ¿cuáles? ANOTE NOMBRE DEL ANIMAL	murieron?	se enfermaron?

WHICH ANIMALS WERE AFFECTED

EFFECTS ON HEALTH AND THE COMMUNITY FROM THE FLOOD

6B. Efectos en la salud y la comunidad en la inundación (SÓLO EN LAS LOCALIDADES DEL BAJÍO)

	4	5	6	7
¿Alguien de su familia se enfermó por la inundación? No=1, Sí=2	¿La inundación incomunicó a la comunidad? No=1; Sí=2	¿La inundación afectó a su casa? No=1; Sí=2	¿Se recuperaron de los daños? SI=1; NO=2	

DID SOMEONE IN THE FAMILY GET SICK? DID IT AFFECT COMMUNICATION DID IT AFFECT YOUR HOUSE DID YOU RECOVER FROM THE DAMAGES

2003/2005? NO=1/SÍ=2 SI NEGATIVO PASE A 6B

DID THE EVENT NEGATIVELY IMPACT THE FOLLOWING

CROP	PLANTED LAND		LAND AFFECTED		6	DID YOU HAVE TO SELL IT?		DID YOU HAVE TO REPLANT?	HOW MUCH DID IT COST	DID IT CAUSE INFESTATION	NAME OF INFESTATION	13		
	1	2	3	4		5	7	7	8	9	10		11	12
Cultivo (MENCIONE CULTIVO)	NO=1; SÍ=2 ANOTÉ CÓDIGO	Superficie sembrada el año de la inundación/sequía		Superficie afectada		¿Iba a destinar a autoconsumo? No=00/Sí=01	Tuvo que comprar? NO=1, SI=2		¿Tuvo que resembrar? No=00/Sí=01	¿Con cultivo resembró?	¿Cuánto le costo?	¿Se plago su cultivo a consecuencia de la inundación/sequía? NO=1/SÍ=2 SI RESPONDE NO, PASE A MÓDULO 7	Nombre de la plaga	¿Tomo alguna medida sanitaria en su cultivo? NO=1/sí=2
COD		HA	¿Cuanto esperaba obtener? TON	HA	% de producción perdida		¿Cuanto tuvo que comprar? TONELADAS	¿Cuanto le costó? EN PESOS	ANOTE CODIGO	ANOTE CULTIVO	ANOTE PESOS	ANOTE CODIGO	ANOTE NOMBRE	ANOTE CODIGO
01	Fresa													
02	Maíz													
03	Sorgo													
04	Trigo													
05	Frijol													
06	Alfalfa													
07	OTRO													

- STRAWBERRY
- CORN
- SORGHUM
- WHEAT
- BEANS
- ALFALFA
- OTHER

**MÓDULO 7. ESTRATEGIAS DE ADAPTACIÓN- ADAPTATION STRATEGIES**

**A. FINANCIAMIENTO Y ACCESO A MERCADO, MOVILIDAD Y DIVERSIFICACIÓN**

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

FINANCING & ACCESS TO MARKET, MOBILITY, & DIVERS. DID THE HAZARD RESULT IN...

- 1 Vender animales para comprar alimento a los otros animales?
- 2 Vender animales para el sustento del hogar?

SELLING ANIMALS TO BUY FOOD FOR OTHER ANIMALS  
SELLING ANIMALS TO SUSTAIN THE HOUSEHOLD

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 4 Tuvo que hacer uso de sus ahorros en dinero
- 5 Recibió remesas extras de familiares, adicionales a las que recibe regularmente?

HAVING TO USE SAVED MONEY  
RECEIVING EXTRA REMITTANCES FROM FAMILY

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 6 Ud. o alguien de su hogar tuvo que pedir préstamos? **NO=1/SÍ=2**
- 7 ¿A quién pidió el préstamo? **1=familia o amigos; 2=prestamistas; 3=cajas de ahorro; 4=bancos; 5=proveedores de insumos; 6=viveristas; 7=comercializadores;**

HAVING TO ASK FOR LOANS  
WHO DID YOU ASK FOR A LOAN?

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 10 ¿Tuvo que comprar semillas de maíz para resembrar o para la siembra del siguiente año?
- 11 Intercambio de su producción por semilla con otra persona (en santa Cruz a esto le llaman "maíz por maíz")

HAVING TO BUY CORN SEEDS TO REPLANT  
EXCHANGING SEEDS WITH ANOTHER PERSON

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 12 Ud. O algún miembro del hogar se fue a EUA buscando trabajo?
- 13 Ud. O algún miembro del hogar se fue a otro estado de la República Mexicana buscando trabajo?
- 14 Dentro de su familia alguien buscó empleo asalariado?
- 15 Abrieron algun negocio (ej. venta de comida)?

A HOUSEHOLD MEMBER GOING TO THE USA FOR WORK  
HOUSEHOLD MEMBER GOING TO ANOTHER STATE TO WORK  
SOMEONE IN THE FAMILY LOOKING FOR SALARIED WORK  
OPENING A BUSINESS

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 17 Cambiaron el tipo de cultivo para el siguiente ciclo?
- 18 Dejaron de sembrar en las zonas afectadas por la inundación/sequia?

CHANGING CROP TYPES  
NOT SEEDING THE AREA OF LAND AFFECTED BY THE HAZARD

¿Cómo resultado de la inundación/sequia.... (REPETIR ESTA INTRODUCCIÓN AL INICIO DE CADA OPCIÓN)

- 19 Tuvieron los hijos que dejar de estudiar?
- 20 Otras medidas que tuvo que tomar

A CHILD HAVING TO QUIT STUDYING  
OTHER MEASURES HAVING TO TAKE

**B. ALMACENAMIENTO**

STORAGE

Durante el período del evento, ud. o algún miembro del hogar...

DURING THE PERIOD , DID A HOUSEHOLD MEMBER...

- 23 Tenía alimentos almacenados (maíz, frijol, otros) que le permitieron sobrellevar las pérdidas?
- 24 Tenía forraje almacenado que le permitió sobrellevar las pérdidas?
- 25 SOLO PARA BAJÍO: Tenía agua potable almacenada para consumo del hogar? (contaminación de pozos)

HAVE STORED FOOD THAT WAS USED TO REPLACE LOSSES  
HAVE FORAGE THAT WAS USED TO REPLACE LOSSES  
HAVE STORED DRINKING WATER TO REPLACE LOSSES

- 26 ¿En su **HOGAR** ha realizado alguna inversión para reducir el daño de las inundaciones? **No=1, Sí=2**

HOUSEHOLD INVESTMENT USED TO REDUCE DAMAGES?

- 27 ¿Qué inversión? ANOTE INVERSIÓN

WHAT INVESTMENT?

- 28 ¿En su **COMUNIDAD** ha realizado alguna inversión para reducir el daño de las inundaciones? **No=1, Sí=2**

COMMUNITY INVESTMENT USED TO REDUCE DAMAGES?

- 29 ¿Qué inversión? ANOTE INVERSIÓN

WHAT INVESTMENT

**MODULO 8: INSTITUCIONES**  
8A. APOYOS GUBERNAMENTALES

**INSTITUTIONS**  
**GOVERNMENT SUPPORT**

		<b>1</b>	<b>2</b>
Le voy a alear una lista de apoyos que entrega el gobierno.		En 2002/2004 ¿Ud. o su familia ha recibido o se ha beneficiado por LEA OPCIONES (ANOTE CÓDIGO 1= NO 2= SÍ)	En 2008 ¿Ud. o su familia ha recibido o se ha beneficiado por LEA OPCIONES (ANOTE CÓDIGO 1= NO 2= SÍ)
<b>COD</b>		<b>ANOTE CÓDIGO</b>	<b>ANOTE CÓDIGO</b>
01	Programa ganadero (PROGAN)		
02	Programa diesel		
03	Programa de apoyos directos al ingreso objetivo (ASERCA)		
04	Programa de apoyos directos a coberturas de precio (ASERCA)		
05	Procampo		
06	Programa Alianza para el Campo		
07	Programa de la mujer en el sector agrario (PROMUSAG)?		
08	Programa de atención a jornaleros agrícolas		
09	Programa de empleo temporat (PET)		
10	Seguro popular		
11	Programa Oportunidades		
12	Programa 70 y más		
13	Programa de apoyo para fomentos productivos (FAPPA)		
14	Programa Estatal de Apoyo a la Nutrición Infantil CRECER		
15	Ha recibido despensas		
16	Ha recibido uniformes, textos o útiles escolares		
17	Ha recibido apoyo para insumos (semillas, fertilizantes, fumigantes)		
18	Otro programa? Cuál(es)?		

HAS YOUR HOUSEHOLD RECEIVED OR BENEFITTED FROM THESE GOVERNMENT INSTITUTIONS

- 3** Alguien en su hogar recibió apoyos para sobrellevar los efectos de la inundación/sequía?  
**4** ¿En que cosnistió el apoyo? 1=dinero; 2=despensas; 3=insumos (fertilizantes, semilla); 4=otro
- 5** ¿De donde venían esos apoyos?
- 6** ¿Su comunidad se organizó para aminorar los problemas que provoco la sequia/inundación en 2003/2005 NO=1/SÍ=2
- 7** ¿Qué tipo de trabajo comunitario realizaron?
- 8** ¿En 2008 usted o algún miembro del hogar realizo trabajo comunitario ? NO=1/SÍ=2
- 9** ¿Qué tipo de trabajo comunitario realizaron?
- 10** ¿Desde 2002/2004 ud. cree que el trabajo comunitario en su comunidad ha: disminuido=1, aumentado=2, mantenido


HAS YOUR HOUSEHOLD RECEIVED SUPPORT TO OFFSET THE EFFECTS OF A HAZARD

WHAT WAS THE SUPPORT FROM WHERE DID THE SUPPORT COME DID THE COMMUNITY ORGANIZE TO DECREASE THE PROBLEMS FROM THE HAZARD

WHAT TYPE OF COMMUNITY WORK DID A HOUSEHOLD MEMBER DO COMMUNITY WORK?

WHAT TYPE OF WORK HAS COMMUNITY WORK INCREASED, DECREASED, REMAINED CONSTANT

- 11** Desde 2002/2004, ud. o alguien en su hogar ha recibido asistencia técnica o capacitación? NO=1; SI=2
- 12** ¿La recibe actualmente? **NO=1; SI=2**
- 13** ¿En qué áreas considera necesario recibir capacitación?  
**ANOTE RESPUESTA**

**MODULO 8: INSTITUCIONES**  
**8B. MEMBRESÍA INSTITUCIONAL**

**INSTITUTIONS**  
**INSTITUTIONAL MEMBERSHIP**

**DID YOU BELONG TO...**

**DID YOU ACTIVELY PARTICIPATE**

**WERE YOU A LEADER**

**MEMBER THAT PARTICIPATED**

**SAME QUESTIONS, BUT FOR 2008**

COD	GRUPOS	1	4	5	6	3	4	5	6	7	
		¿En 2002/2004 Ud. o algún otro miembro de su hogar a perteneció a (LEA OPCIONES) 1= NO; 2= SÍ	¿Participaba activamente? 1= NO; 2= SÍ	¿ERA sido líder o autoridad en ... 1= NO; 2=SÍ	Codigo miembro de familia que participó	¿En 2008 Ud. o algún otro miembro de su hogar a perteneció a LEA OPCIONES) 1= NO; 2= SÍ	¿Participa(ba) activamente? 1= NO; 2= SÍ	¿Es o ha sido líder o autoridad en ... 1= NO; 2=SÍ	Codigo miembro de familia que participó	¿Cuál de estas organizacione sle ha le ha brindado más ayuda a su hogar para enfrentar problemas	
		ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	ANOTE CÓDIGO	
01	para la comercialización										COMMERICAL GROUP
02	para créditos										FOR CREDIT
03	de productores										PRODUCERS GROUP
04	ganaderos										LIVESTOCK
05	de riego o agua potable										IRRIGATION GROUP
06	políticos										POLITICAL
07	Sociedades										SOCIAL
08	DIF (talleres comunitarios)										
09	religiosos										RELIGIOUS
10	de padres de familia										PARENTS
11	Otras ¿Cuál?										OTHER'

**8** Como consecuencia de la inundación/sequia....? **NO=1/ Sí=0**

**9** Ud. U otro miembro del hogar comenzó a ser miembro de alguna organización? **NO=1; Sí=0**

**10** Alguien del hogar tuvo conflicto con el grupo de alguna de las organizaciones a las que pertenecía? **NO=1; Sí=2**

**11** Alguien en su hogar estableció nuevos contactos con autoridades o funcionarios públicos? **NO=1; Sí=2**

**12** ¿Usted o algún miembro de su familia ha trabajado como funcionario público (municipal o estatal) en los últimos 10 años? **NO= 1; Sí=2**

**13** ¿En qué período? **ANOTE PERIODO (AÑOS)**

**14** ¿Usted o algún miembro de su familia tiene relaciones de amistad o parentesco con algún funcionario público? **NO=1; Sí=0**

**DID THE HAZARD CAUSE:**


HOUSEHOLD TO JOIN AN ORGANIZATION

HOUSEHOLD MEMBER TO HAVE A CONFLICT WITH A GROUP THEY BELONG TO

HOUSEHOLD TO ESTABLISH

HOUSEHOLD MEMBER WORKING WITH MUNICIPAL OR STATE ORGANIZATION

WHEN?

HOUSEHOLD TO HAVE GOOD RELATIONS WITH A PUBLIC ORGANIZATION



**IA. Climate Hazards and Adaptation Strategies – Household Survey  
(revised version)**

**Intro**

- confidentiality and anonymity clauses
- other introductory statements – per common local practice

Settlement Name	Social Group code
Settlement code	Date

**Demographics**

**Q.1.** Are you the head of household? (1 answer)

1.1. **Yes**.....continue with Q2

1.2. **No**.....ask to speak with head of household and repeat **Q1**; if unavailable, end interview

**Q.2.** Note gender (1 answer)

2.1. Male

2.2. Female

**Q.3.** How old are you? Note age (1 answer)

3.1. \_\_\_\_\_

**Q.4.** How many people live in your household in total (Including gender)? (6 answers)

Q.2.1 How many are younger than 15?

Q.2.2. How many are between 15 and 60 years of age?

Q.2.3. How many are over 60 years of age?

	Age<15	Age 15-60	Age >60
No. of permanent residents in household			
Female			

**Q.5.** How many years at school have you completed? Check list and fill out the table

5.1. No formal education

5.2. 4 years of formal education or less

5.3. More than 4 but less than 8 years of formal education

5.4. 8 years of formal education

5.5. Between 8 and 12 years of formal education

5.6. Over 12 years of formal education

5.7. Other/did not answer

**Education**

	No Schooling	Education <8	Education 8-12	Education >12
Number of Household Members				
Female				

**5b. In the table below, please provide information about the medical problems that have affected your family in the past few years.**

Year	Male (>15 - <60)		Female (>15 - <60))		Child (<15)		Expenditure Rs.	Mandays lost
	Number	Disease	Number	Disease	Number	Disease		
1-2								
3-5								
More than 5 years ago								

**Q.6.** How long have you been living in this village/community? Include total time, even if not in the same house/apartment/accommodation. Read list (1 answer)

- 6.1. Less than 1 year ..... end interview
- 6.2. More than 1 but less than 5 years
- 6.3. More than 5 years but less than 10
- 6.4. More than 10 years
- 6.5. Other/did not answer

**Q.7.** What is your households source of income? Allow self-selection (not from list) and note answer in 7.0. Then read list and ask if any other source of income applies. (If more than 1 answer, ask Q.8. If only 1 answer, skip to Q9).

- 7.1. Agriculture (labor on personally owned or leased land for grain, fruit, fiber or any combination of these)
- 7.2. Labor (labor on someone else's land or livestock keeping for someone else)
- 7.3. Livestock (keeping any type of animals for meet, eggs, milk, skin or wool or any combination of these)
- 7.4. Forest products (including wood, fiber, fruits, forest (non domesticated) animals)
- 7.5. Trade (owning or independently trading any type of products for money)
- 7.6. Salary (from employment in any type of work not covered by above 7.1. to 7.5.)
- 7.7. Pension (any type of income derived from previous investments or employment)
- 7.8. Remittances (any type of income from relatives that do not live/work in the same community)
- 7.9. Rent/Interest (any type of income from non-work activity)
- 7.10. Other/did not answer

**Q.8.** You mentioned more than 1 source of income. What is the primary or main source of your household's income? Read list again (1 answer)

- 8.1. Agriculture (labor on personally owned or leased land for grain, fruit, fiber or any combination of these)
- 8.2. Labor (labor on someone else's land or livestock keeping for someone else)
- 8.3. Livestock (keeping any type of animals for meet, eggs, milk, skin or wool or any combination of these)
- 8.4. Forest products (including wood, fiber, fruits, forest (non domesticated) animals)
- 8.5. Trade (owning or independently trading any type of products for money)

- 8.6. Salary (from employment in any type of work not covered by above 8.1. to 8.5.)
- 8.7. Pension (any type of income derived from previous investments or employment)
- 8.8. Remittances (any type of income from relatives that do not live/work in the same community)
- 8.9. Rent/Interest (any type of income from non-work activity)
- 8.10. Other/did not answer

**Q.9.** What is the size of your total income per year? (read list, 1 answer) [*locally relevant ranges, numbers in local currency, fitting in low, medium low, medium, medium high and high categories*]

- 9.1.
- 9.2.
- 9.3.
- 9.4.
- 9.5. Other/did not answer

**Q.10.** In the last 10 years, what is the trend of your primary household's income? (read list) (1 answer)

- 10.1. Increased
- 10.2. Stayed the same
- 10.3. Decreased

**Q.11.** (Only if Q.5. has multiple answers). What is the trend of your other income sources? (read list) (1 answer)

- 11.1. Increased
- 11.2. Stayed the same
- 11.3. Decreased

**Q.12.** What are the major assets your household owns? (Read list, multiple answers)

- 12.1. House/apartment where we live
- 12.2. House/apartment other than the one we live in
- 12.3. Auxiliary buildings (stables, sheds, grain stores)
- 12.4. Land (including cultivated and uncultivated land, orchards, pastures etc. i.f. selected, ask Q.13, otherwise skip to Q.16 )
- 12.5. Forest (if selected ask Q.14, otherwise skip to Q.16 )
- 12.6. Livestock (if selected ask Q15, otherwise skip to Q.16 )
- 12.7. Machinery (including tractors, harvesters etc)
- 12.8 Right of access (to communal resources, such as pasture, forest, fishing in the river etc)
- 12.9 Other/did not answer

**Q.13.** What is the total area of the land you own? (read list, 1 answer) [*If ha not common unit, will be modified to use local units*]

- 13.1. Less than 1 hectare
- 13.2. More than 1 but less than 2 hectares
- 13.3. More than 2 but less than 10 hectares

- 13.4. More than 10 hectares
- 13.5. Other/did not answer

**Q.14.** What is the total area of the forest you own? (read list, 1 answer)

- 14.1. Less than 1 hectare
- 14.2. More than 1 but less than 2 hectares
- 14.3. More than 2 but less than 10 hectares
- 14.4. More than 10 hectares
- 14.5. Other/did not answer

**Q.15.** What type of livestock do you own (read list, multiple answers)

- 15.1. Poultry (includes chicken, ducks, geese, and any other domesticated bird)
- 15.2. Cattle (includes cows and buffalos)
- 15.3. Goats
- 15.4. Sheep
- 15.5. Local 1 (includes alpaca/vicuna)
- 15.6. Local 2 (TBD)
- 15.7. Other/did not answer

**Q.16.** How many climate hazards/weather events happened in your area in the past 10 years? (Read list, multiple answers, note NUMBER of events in the table below, column 16.1, before asking Q. 17)

**Q.17.** What are the climate hazards/weather events that happened in your area more than 10 years ago, but less than 20 years ago? (Read list, multiple answers, note in the table below, column 17.1)

Event	16.1. Within last 10 years	17.1. More than 10 years ago but less than 20 years ago
Draught (including late rain, too little rain)		
Flooding (including early rain, too much rain and rivers/lakes overflow)		
Hurricanes (including severe storms and sea surges)		
Local 1		
Local 2		
Local 3		

Local 4		
Other/did not answer		

**Q.18.** In the case of climate hazards you mentioned, what did you do after the immediate danger passed in regard to your primary source of income? (**DO NOT** probe, write down UNPROMPTED ANSWERS, multiple answer)

- 18.1. \_\_\_\_\_
- 18.2. \_\_\_\_\_
- 18.3. \_\_\_\_\_
- 18.4. \_\_\_\_\_
- 18.5. \_\_\_\_\_
- 18.6. Nothing
- 18.7. Did not answer

**Question 18a. How have the above hazards affected your ability to earn a living? Your other social relationships and cultural interactions?**

- 1. Did not affect at all
- 2. Affected somewhat
- 3. Affected a lot

**Question 18b. When you face an environmental problem, what are the ways in which you attempt to ensure that its effects on you and your family are as low as possible?**

**Question 18c. What or who helps you most in meeting environmental problems of different kinds?**

**Q.19.** Just to verify, did you do any of the following activities to ensure your income? (read list, multiple answers, note down in table below)

- 19.1. Mobility (including “moved household”, “changed the field for growing crops”, “moved livestock”, “moved the location of my shop”, “moved the location where I sell my products”, etc)
- 19.2. Diversification (including “changed type of crop”, “changed my income source”, “changed type of livestock”, “learned another trade”, “bought different type of machinery”)

- 19.3. Storage (including “contributed to community storage”, “asked for grain/fertilizers/seeds/food etc from community storage”)
- 19.4. Pooling (including “joined with my neighbors/relatives to work fields together/grow livestock together/use forests together or any other activity directly related to source of income”)
- 19.5 Market exchange (includes “started growing products for sale”, “sold my assets”, “opened new shop”)
- 19.6. Other/did not answer

	19. (tick)	20. Income effect	21. Asset effect	22. Community assets effect	23. Environment effect
19.1 Mobility					
19.2 Diversification					
19.3 Storage					
19.4 Pooling					
19.5 Market exch.					
19.6 Other/did not answer					

**Q.20.** How did the actions you just mentioned affect your income? (Read only what the respondent selected from Q.19, read possible effects from below and note in table above, column 20)

- 20.1. High positive effect (mark ++)
- 20.2. Positive effect (mark +)
- 20.3. Neutral effect (mark 0)
- 20.4. Negative effect (mark -)
- 20.5. High negative effect (mark --)
- 20.6. Did not answer

**Q.21.** How did the actions you just mentioned affect your assets? (Read only applicable from Q.19., read possible effects from below and note in table above, column 21)

- 21.1. High positive effect (mark ++)
- 21.2. Positive effect (mark +)
- 21.3. Neutral effect (mark 0)
- 21.4. Negative effect (mark -)
- 21.5. High negative effect (mark --)
- 21.6. Did not answer

**Q.22.** How did the actions you just mentioned affect your community? (Read only what the respondent selected from Q.19., read possible effects from below and note in table above, column 22)

- 22.1. High positive effect (mark ++)
- 22.2. Positive effect (mark +)
- 22.3. Neutral effect (mark 0)
- 22.4. Negative effect (mark -)
- 22.5. High negative effect (mark --)
- 22.6. Did not answer

**Q.23.** How did the actions you just mentioned affect the environment? (Read only what the respondent selected from Q. 17, read possible effects from below and note in table above, column 21)

- 23.1. High positive effect (mark ++)
- 23.2. Positive effect (mark +)
- 23.3. Neutral effect (mark 0)
- 23.4. Negative effect (mark -)
- 23.5. High negative effect (mark --)
- 23.6. Did not answer

**Q.24.** How much did the actions you mentioned cost you? (Read list, 1 answer)

- 24.1 less than 1/5 of assets (<20%)
- 24.2. between 1/5 and 2/5 of assets (21-40%)
- 24.3. between 2/5 and 3/5 of assets (41-60%)
- 24.4. more than 3/5 of assets (>61%)
- 24.5 Other/did not answer

**Q.25.** Where do you learn about climate and weather? (Read list, multiple answers)

- 25.1. Community (including neighbors, local residents etc)
- 25.2. Buyers or suppliers or my products (including markets, shops, cooperatives)
- 25.3. Local government officials
- 25.4. TV/newspapers/radio/internet
- 25.5. Scientists and other organizations (including NGOs, etc).
- 25.6. Other/did not answer

**Q.26.** Do you have access to the following institutions? (Read list, multiple answers, mark answers with a checkmark in column 26.1 of the table below)

**Q.27** How many times a year do you contact the institutions you just mentioned? (read only what respondents selected in Q26 and mark answers in column 27.1 in the table above)

**Q.28** Do the institutions you just mentioned usually contact you, or you contact them? (read only what respondents selected in Q26 and mark answers in column 28.1 in the table above) [*the table needs to be adapted to local institutions*]

28.1 The institution contacts me – mark Y in column 28.1

28.2 I contact the institution – mark N in column 28.1

Institution	26.1 Access (yes/no)	27.1 Access frequency	28.1 Leadership
-------------	-------------------------	--------------------------	--------------------

		<b>(annual)-Number</b>	<b>(yes/no/???)</b>
Agri. Coop.			
Milk Coop.			
Panchayat			
Govt. dept. Forest			
Govt. dept. Agri			
Govt. dept. Horti.			
Govt. dept. Revenue			
Govt. dept. Health			
Govt. dept. Vet..			
NGO			
Bank			
Village comm.			
Religious committee			
Women's group			
Youth group			
Self-help group			
User group			
Other (_____)			
Other (_____)			
Other (_____)			
Did not answer			

**Q.29.** In the past year, how many times have you visited the closest village/town to see your relatives or friends? (one answer, write number)

- 29.1. \_\_\_\_\_
- 29.2. Did not visit
- 29.3. Did not answer

**Q.30.** In the past year, how many times have you visited the closest village/town for a festival or other similar occasion (not to buy or sell things)? (one answer, write number)

- 30.1. \_\_\_\_\_
- 30.2. Did not visit
- 30.3. Did not answer

**Q.31.** In the past year, how many times have you visited the closest village/town in total (for any reason)? (one answer, write number)

- 31.1. \_\_\_\_\_
- 31.2. Did not visit
- 31.3. Did not answer



## Appendix 3 - Methodology

### Quantitative analysis techniques:

Cluster analysis using Wards linkages

Kruskal-Wallis analysis of variance

### Definition of vulnerability:

“Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity.”<sup>1</sup>

VULNERABILITY		
Exposure	Adaptive Capacity	Sensitivity
<ul style="list-style-type: none"><li>Number of Climate Hazards</li></ul>	<ul style="list-style-type: none"><li>Asset Diversity</li><li>Diversity of Institutional Access</li><li>Frequency of Contact with Institutions</li></ul>	<ul style="list-style-type: none"><li>Total Income</li><li>Income Diversity</li><li>Incidence of Disease</li><li>Household Size</li><li>Literacy rate</li></ul>

To measure vulnerability, we broke the concept into its three components: exposure, adaptive capacity, and sensitivity. Data from the household surveys was used to measure each of these components of vulnerability. Specific questions that addressed these components follow:

#### Exposure

*Exposure to climate hazards was measured using results from the following questions:*

How many climate hazards/weather events happened in your area in the past 10 years? (household heads were asked to answer this question with specific regard to droughts, flooding, hurricanes, and local events)

Household exposure to each of these hazards was aggregated to produce the exposure variable used in our analysis.

#### Adaptive Capacity

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<sup>1</sup> IPCC. "Assessment of adaptation practices, options, constraints and capacity." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge UP, 2007. 717-43. Print. P. 21

### *Asset diversity*

What are the major assets your household owns? (household heads selected from the the following list: house/apartment where they live, house/apartment other than one lived in, auxiliary buildings, land, forest, livestock, machinery, rights of access)

### *Diversity of institutional access*

Do you have access to the following institutions? : Agricultural cooperative, milk cooperative, government forestry department, government agriculture department, government department of horticulture, government revenue department, government health department, government veterinary department, non-governmental organizations, banks, village committees, religious committee, women's groups, youth group, self-help group, user groups, other

### *Frequency of institutional contact*

How many times a year do you contact these institutions?: Agricultural cooperative, milk cooperative, government forestry department, government agriculture department, government department of horticulture, government revenue department, government health department, government veterinary department, non-governmental organizations, banks, village committees, religious committee, women's groups, youth group, self-help group, user groups, other

## **Sensitivity**

### *Total Income*

*In West Africa, total income was determined using a relative measure that asked whether the household was as well off, better off, much better off, worse off, or much worse off than surrounding households. In Latin America, respondents provided a numerical answer for total annual income.*

### *Income Diversity*

What is your household's source of income? (*household head selected from the following list*) Agriculture, labor, livestock, forest products, trade, salary, pension, remittances, rent/interest, other

### *Incidence of Disease*

*Incidence of disease was determined by dividing the total number of diseases to a household reported by the total population of the household.*

### *Household Size*

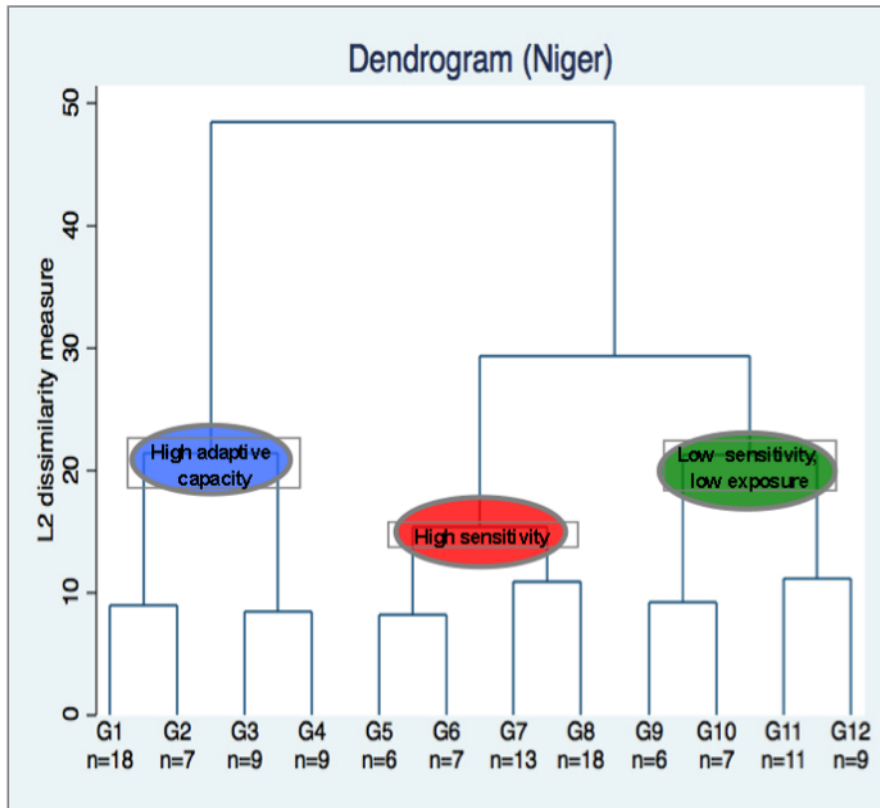
*Respondents were asked to list the household population by gender and age. These responses were aggregated to provide total household size.*

## Literacy rate

Literacy rate was calculated by dividing the number of individuals in a household with any education by the total number of people in the household.

## Dendrograms

Once data has been clustered, it is possible to produce a dendrogram. A dendrogram is a visualization of how the data breaks into clusters around the variables used in the analysis. As can be seen in the Niger dendrogram below, our data broke into three clusters. The labels were generated using the descriptive data, described later in this appendix.



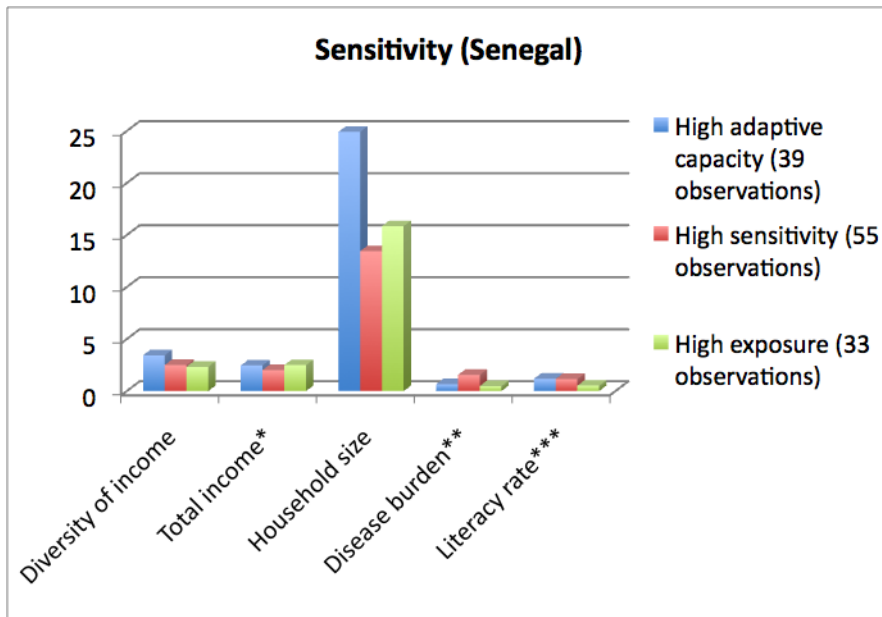
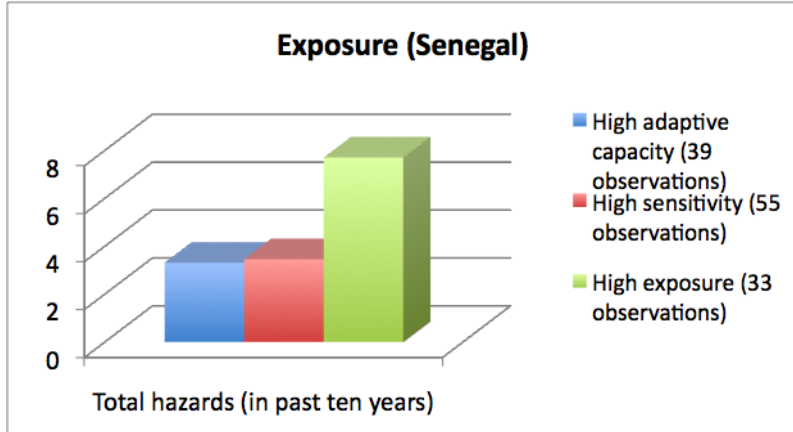
## Detailed Results

### Senegal

Cluster 1: High adaptive capacity

Cluster 2: High sensitivity

Cluster 3: High exposure to hazards

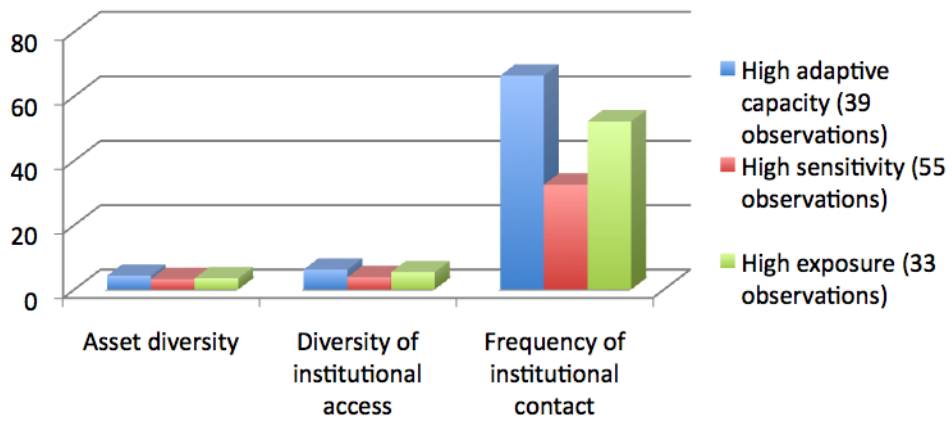


\* Total income is a relative measure. Household heads were asked to estimate their income relative to other community members' income

\*\*Disease burden shown as standardized value +1

\*\*\*Literacy rate shown as standardized value +1

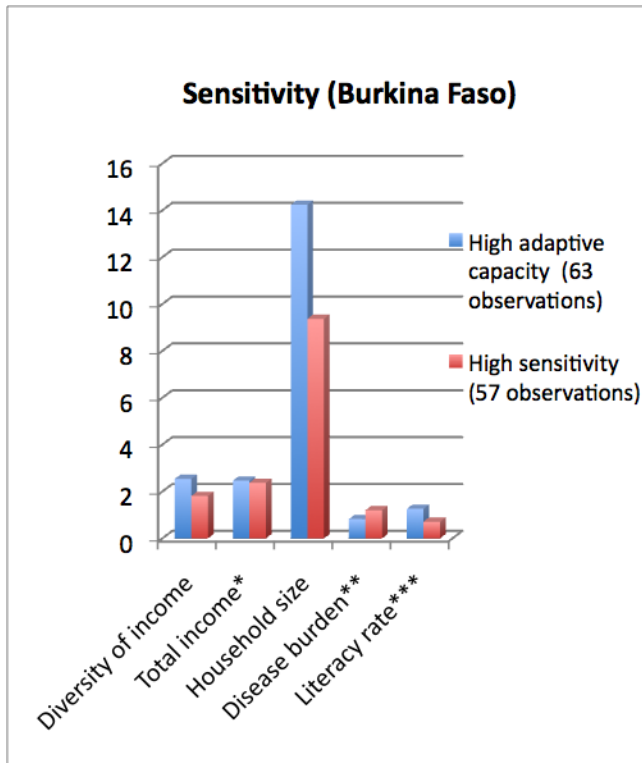
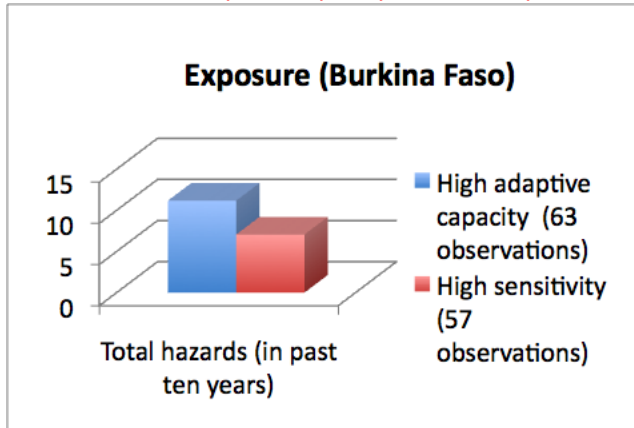
### Adaptive Capacity (Senegal)



**Burkina Faso**

Cluster I: High adaptive capacity and high exposure to hazards

Cluster II: Low adaptive capacity and low exposure to hazards

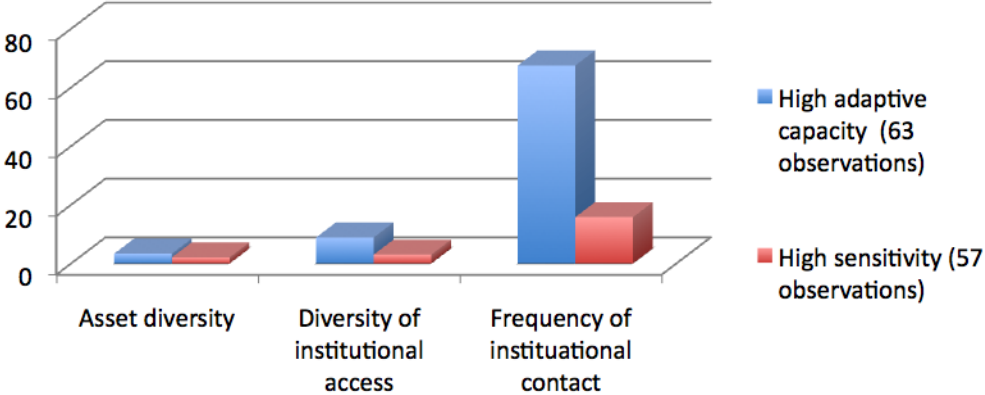


\* Total income is a relative measure. Household heads were asked to estimate their income relative to other community members' income

\*\*Disease burden shown as standardized value +1

\*\*\*Literacy rate shown as standardized value +1

### Adaptive Capacity (Burkina Faso)

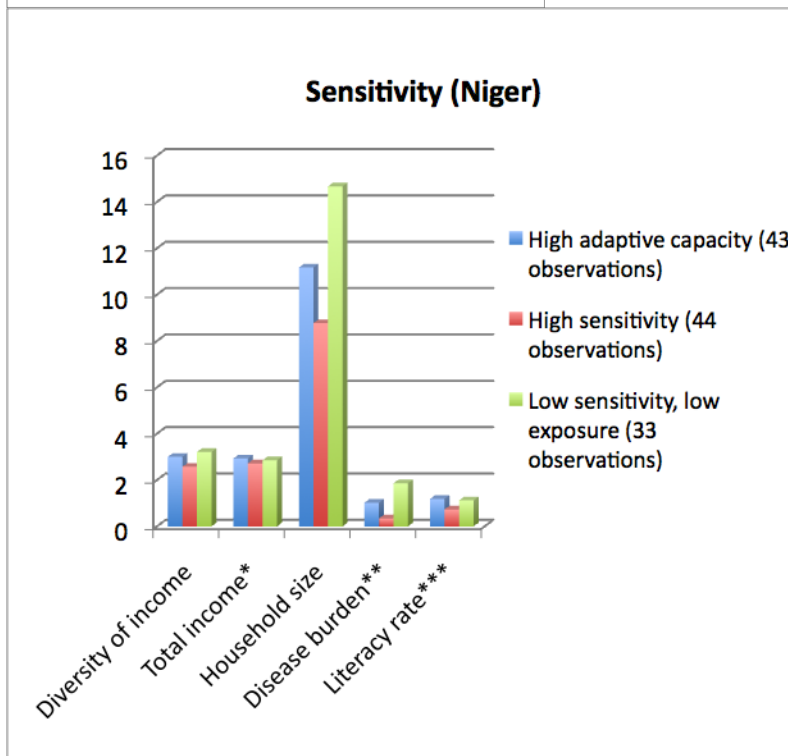
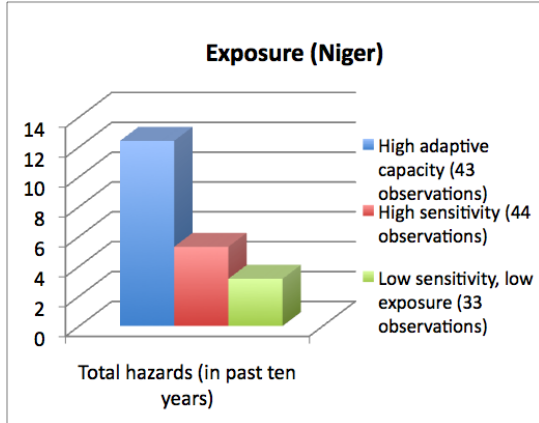


## Niger

Cluster I: High adaptive capacity and high exposure

Cluster II: High sensitivity

Cluster III: Low sensitivity and low exposure

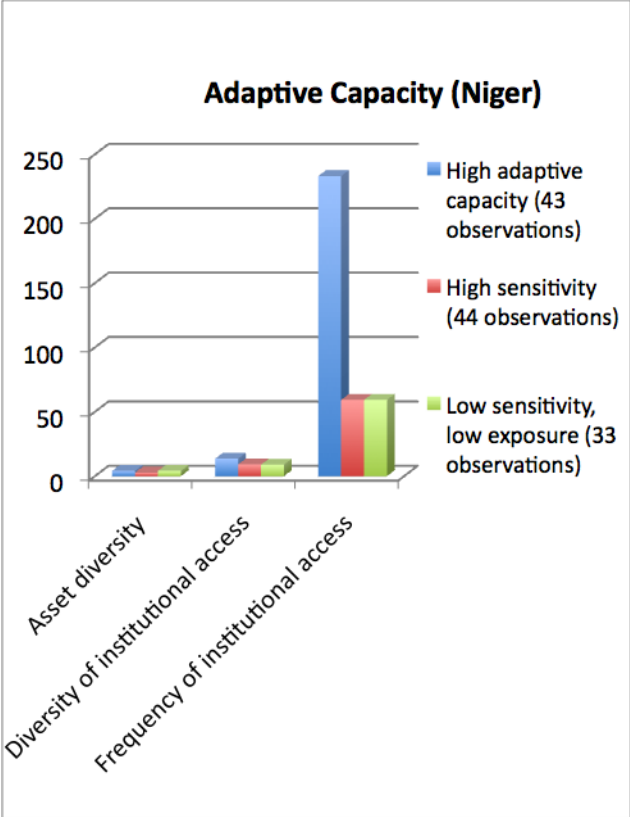


\* Total income is a relative measure. Household heads were asked to estimate their income relative to other community members' income

\*\*Disease burden shown as standardized value +1

\*\*\*Literacy rate shown as standardized value +1



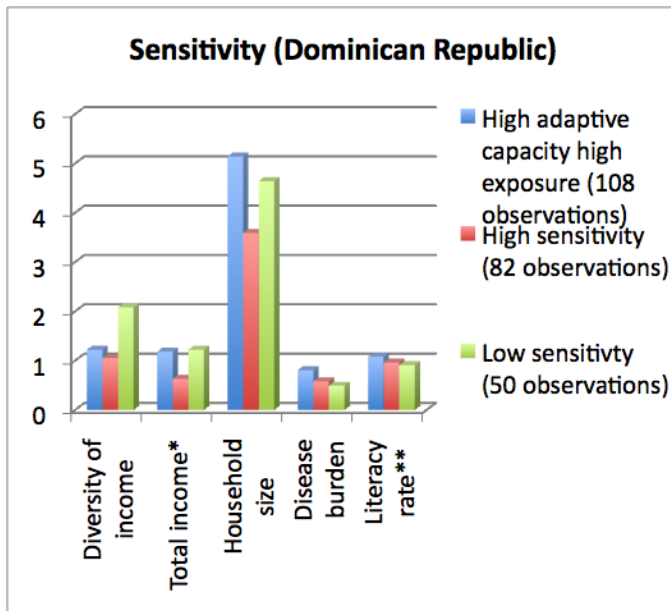
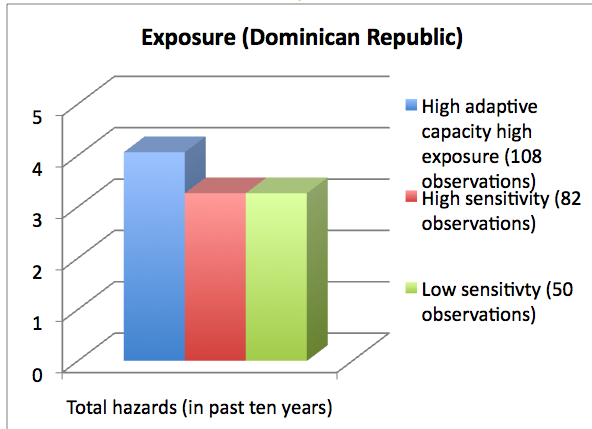


**Dominican Republic**

Cluster I: High adaptive capacity and high exposure

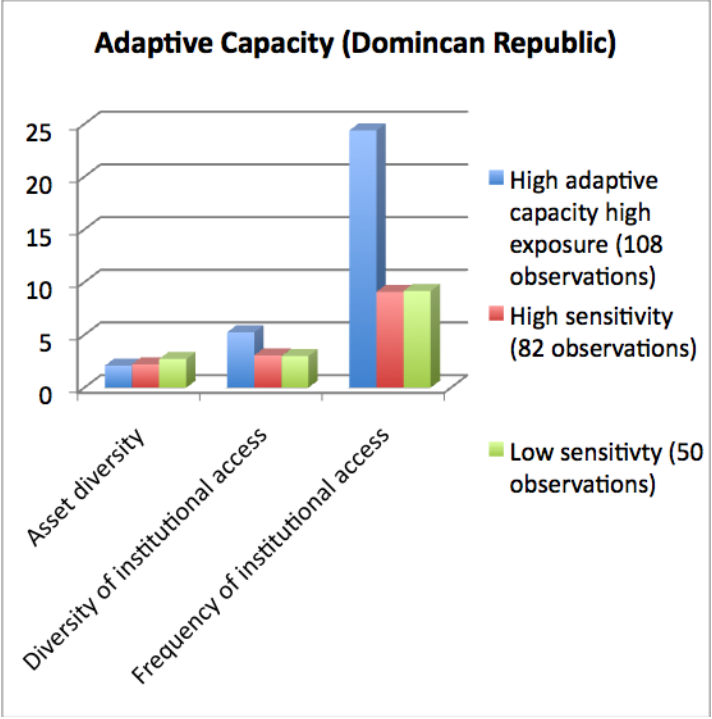
Cluster II: High sensitivity

Cluster III: Low sensitivity



\* Total income shown as standardized value +1

\*\*Literacy rate shown as standardized value +1

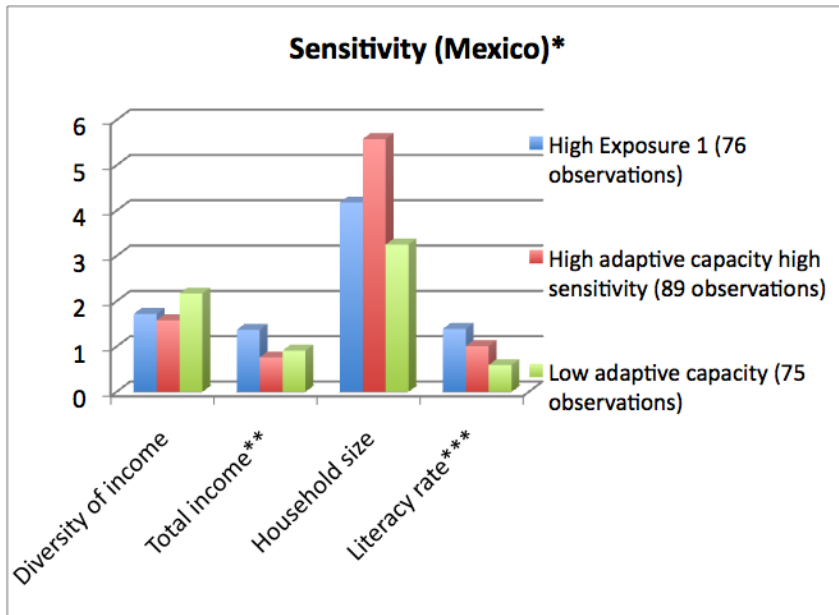
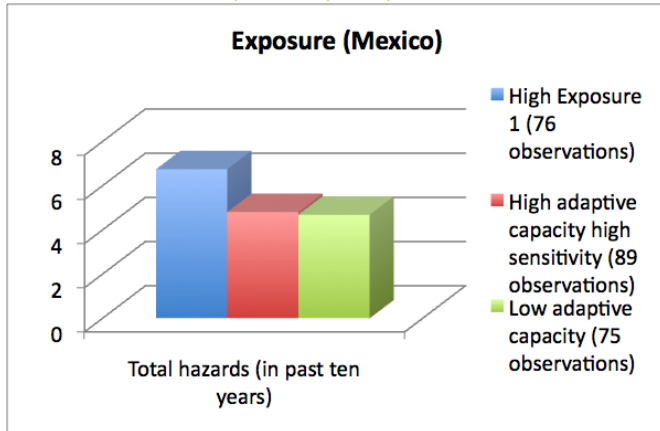


**Mexico**

Cluster I: High exposure

Cluster II: High adaptive capacity and high sensitivity

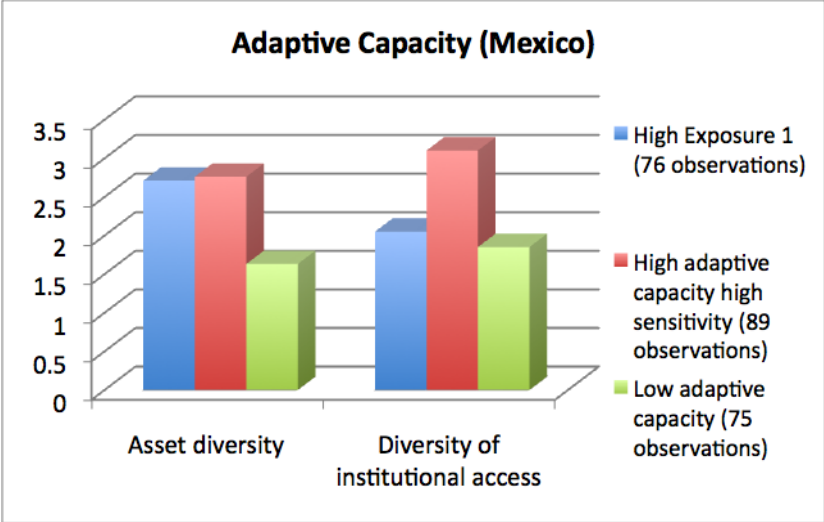
Cluster III: Low adaptive capacity



\* Mexico's survey data does not provide health information, thus average health is unrepresented in this graph

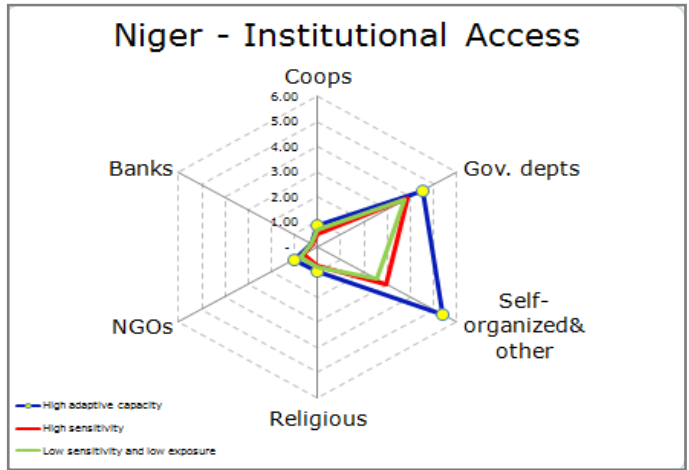
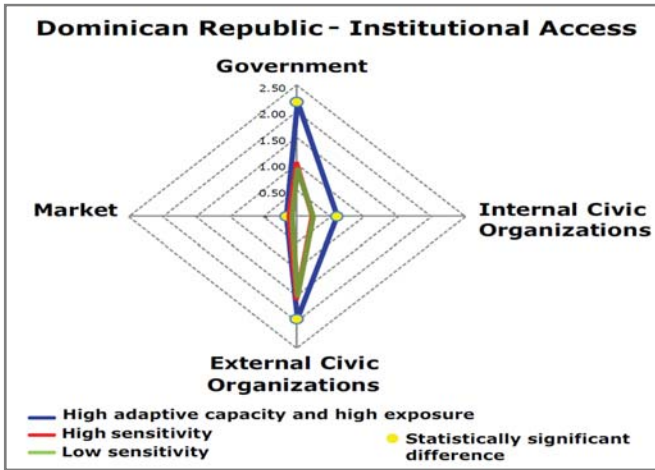
\*\* Total income shown as standardized value +1

\*\*\* Literacy rate shown as standardized value +1



## Appendix 4 – Spider graphs

Finding 4:



Finding 5:

